

T-O to 15 m (50 ft) at S/L: B 1,442 m (4,730 ft)
 Landing from 15 m (50 ft) at S/L: B 753 m (2,470 ft)
 Landing run at S/L 505 m (1,657 ft)
 Attack radius, allowances for 5 min combat over target and 10% fuel reserves:
 lo-lo-lo: A 300 n miles (556 km; 345 miles)
 B 285 n miles (528 km; 328 miles)

hi-lo-hi: A 480 n miles (889 km; 553 miles)
 B 500 n miles (926 km; 576 miles)
 Ferry range with two 1,000 litre (264 US gallon; 220 Imp gallon) drop tanks, 10% reserves 1,800 n miles (3,333 km; 2,071 miles)
 g limits +7.33/-3

AM

AIRBUS MILITARY SAS

404 Avenida de Aragon, E-28022 Madrid, Spain
 Web: www.airbusmilitary.com
 PRESIDENT: Francisco Fernández Sáinz
 A400M PROGRAMME MANAGER (OCCAR): Olivier Etchevers
 CHIEF ENGINEER: Alain Cassier
 SENIOR VICE-PRESIDENT COMMERCIAL: Richard Thompson
 CUSTOMER INTERFACE DIRECTOR: Angel Hurtado
 VICE-PRESIDENT MARKETING: David R Jennings

PARTICIPATING COMPANIES

- Airbus SAS (France)
- EADS CASA (Spain)
- FLABEL (Belgium)
- TAI (Turkey)

Airbus Military was legally established in January 1999 as a ‘Société par Actions Simplifiées’ as the prospective manufacturer of the Airbus A400M, formerly known as the Future Large Aircraft (FLA). Airbus is the major (63 per cent) shareholder in Airbus Military; TAI, OGMA and FLABEL are full risk-sharing partners. Airbus Military has assigned overall programme management, during development, to Airbus in Toulouse; as the programme reaches the production phase, responsibility will progressively transfer to Spain.

Conceptual work was undertaken by the European FLA Group (Euroflag). Euroflag Srl originally formed 17 June 1991, with headquarters in Alenia head office in Rome, to manage European FLA development. Aerospatiale, Alenia, British Aerospace, CASA and Daimler-Benz Aerospace Airbus (DaimlerChrysler from 1998) had equal shares in Euroflag Srl; MoUs established 1992 with FLABEL (SABCA, SONACA, ASCO and BARCO) of Belgium, OGMA of Portugal and Turkish Aerospace Industries (TAI) of Turkey to allow integrated participation in FLA programme; BAE and FLABEL were industrial, not national, partners contributing their own funds, although the UK government announced in December 1994 that membership was to be upgraded to national participation.

The partners agreed in September 1994 to industrialise the programme by transferring it to their existing airliner production company; formal announcement was made on 14 June 1995 that Airbus Military Company would be established. This eventually occurred in January 1999, when it replaced Euroflag, which then disbanded. Programme makes use of Airbus procedures and industrial infrastructure and takes advantage of technologies developed for Airbus airliners. The projected percentage shares for R&D financing at that time were Germany 25.7, France 17.2, UK 15.5, Italy 15.1, Spain 12.4, Turkey 6.9, Belgium 4.1 and Portugal 3.1.

By early 1997, the FLA programme had lost development sponsorship by the principal participating governments, although military commitments remained, subject to the aircraft being produced with commercial funding. Programme weakened in 1997 by unilateral German negotiations with Ukraine over Antonov An-7X (Westernised An-70), which ultimately proved fruitless.

Airbus Military submitted responses to the seven-nation FLA RFP (request for proposals, dated September 1997) on 29 January 1999 and to the competitive Future Transport Aircraft (FTA) RFP issued to Boeing, Airbus and Lockheed Martin by Belgium, France, Spain and the UK on 31 July 1998. Acceptance of A400M formally announced by all seven members on 27 July 2000; subsequently, on 19 June 2001, MoU signed by seven of nine participating nations (Belgium, France, Germany, Luxembourg, Spain, Turkey and the UK) concerning joint procurement through OCCAR, with Italy and Portugal expected to follow suit in the near future. In the event, Italy announced intention to withdraw from project on 25 October 2001, with Portugal following suit in early 2003.

Programme encountered further difficulties in early 2002. Although OCCAR signed memorandum of understanding with Airbus Military Company on 18 December 2001 for 196 aircraft for eight countries, Germany failed to secure parliamentary approval for funding before agreement expired on 31 January 2002; Germany finally announced intention to go ahead with purchase at beginning of December 2002, by which time the number of aircraft involved had fallen from 73 to 60. Subsequently, on 27 May 2003, launch order for 180 aircraft signed in Bonn by OCCAR and Airbus Military Company, with industrial programme formally launched four days later, on 31 May; previously, on 6 May, Europrop International TP400-D6 engine chosen to power the A400M.

Clarification of the programme organisation led to Airbus Military being reconstituted as a Spanish company, Airbus Military S.L, with registered offices in Madrid. Shareholders comprise Airbus (representing EADS and BAE Systems), EADS CASA of Spain, FLABEL of Belgium and TAI of Turkey.

AIRBUS MILITARY A400M

TYPE: Medium transport/multirole.

PROGRAMME:

DEVELOPMENT MILESTONES

Requirement issued (Euroflag established)	Apr 89
Feasibility study completed	May 95
Airbus Military Company established	Jan 99
Technical/commercial proposals to MoDs	Jan 99
Programme launched (official go-ahead)	May 03
First metal cut	Jan 05
First powerplant test run	Feb 06
First flight (scheduled)	Jan 08
First delivery (France)	Oct 09

Original FIMA programme replaced April 1989 by five-nation industry MoU to develop four-turboprop, new technology transport to replace C-130 Hercules and C.160 Transall; Independent European Programme Group (IEPG) defined Outline European Staff Target (OEST) during 1991; initial studies undertaken by Euroflag (European Future Large Aircraft Group) organisation, which name reflected working designation Future Large Aircraft (FLA). Western European Union report in third quarter of 1991 concluded Euroflag FLA should form core of future European military transport capability to support Rapid



Artist's impression of Airbus Military A400M

1040469



Airbus A400M cockpit mockup was accepted by the customer (OCCAR) on 22 September 2006

1040470

Reaction Corps; national armament directors of Belgium, France, Germany, Italy, Portugal, Spain and Turkey affirmed support for 12 month prefeasibility study completed by Euroflag in late 1992; UK MoD declined involvement, but retained observer status; UK participation privately maintained by BAE and Shorts (10 per cent of BAE work); European Staff Target and intergovernmental MoU signed by seven nations in 1993; full feasibility programme officially started October 1993, by which time cargo hold width and height increased from original 3.66 m (12 ft 0 in) and 3.55 m (11 ft 7 7/4 in), respectively; study finished May 1995 and submitted to European defence ministries. Meanwhile, FLA underwent profound change in April 1994 when turboprops deemed incapable of providing desired performance; aircraft recast with four turboprops of new design. Discussion of a ‘close association’ between Euroflag and Airbus Industrie began third quarter of 1993 and formalised in June 1995.

Launch of the predevelopment phase (PDP) was postponed at least six months from early 1996 as a result of funding uncertainties. Original intention was for PDP to run from 1996 to 1998 and define a comprehensive specification for the aircraft and contractual forms and conditions against which the partner nations would make commitments. Full development and production phase (DPP) scheduled to follow directly on from PDP and terminate with first flight in 2002. Customer deliveries were then planned to begin in 2004.

France announced funding withdrawal from FLA development on 13 May 1996 and UK failed to rejoin the programme later that year, despite intention announced in December 1994 (when the RAF purchased Lockheed Martin C-130J Hercules). However, Germany became first to sign a European Staff Requirement, on 24 July 1996, although having terminated official funding for FLA development in previous month. AMC accordingly announced a ‘single-phase’ programme in May 1996.

The new programme schedule started in mid-1998 with a set of formal prelaunch activities (PLA), largely funded by industry and lasting 12 months, leading to a fully documented proposal for the Airbus A400M. This contained the technical proposal, including the aircraft specification and performance guarantees, and the commercial proposal with firm and fixed prices; a full set of contractual terms and conditions; and detailed planning of the single-phase programme. Strategic workshares (detailed enough to allow industry to provide the necessary resources to complete the proposal) were agreed at the start of PLA.

February 1999 delivery of the A400M proposal, initiated a 12-month period of negotiation of individual national requirements before planned official launch during early 2000 to meet an ESR now supported by Belgium, France, Germany, Italy, Spain, Turkey and the UK, but not Portugal. The ‘PLA + single phase’ programme provides industry with an uninterrupted development schedule and strong commitments from governments, while it also meets the customers’ requirement that industry carries as much of the development risk as possible.

A meeting in March 2000 saw Belgium, France, Italy, Spain and Turkey identify a requirement for 131 A400Ms (37 fewer than expected) while, on 16 May, UK announced its intention to buy 25 aircraft (becoming first to fully commit). France and Germany

followed on 9 June 2000. Seven participating nations announced selection of A400M on 27 July, committing to 225, including one for Luxembourg, although Turkey had reduced planned procurement to 10 at time of MoU signature in June 2001. Portugal announced requirement for four shortly thereafter and subsequently rejoined programme as a risk-sharing and industrial partner in early 2001. By June 2001, however, number of aircraft had fallen to three and Portugal subsequently withdrew in early 2003. MoU of 18 December 2001 on development and acquisition of A400M covered 196 aircraft, omitting 16 for Italy which, in late October 2001, revealed it would not proceed with purchase. Formal launch was expected in early 2002, but was delayed for over a year as consequence of German failure to obtain parliamentary funding approval. However, Germany made commitment in December 2002 to 60 aircraft and programme officially launched on 27 May 2003, with signature of contract for 180 aircraft by OCCAR (Organisation Conjointe de Co-operation en matière d'Armement), acting on behalf of seven launch customers, and Airbus Military.

Subsequently, in 2005, South Africa and Malaysia ordered eight and four aircraft respectively and became programme partners. Engine selection announced 6 May 2003; propeller on 24 July 2003; Milestone 1 (submission of quality plan) passed 29 August 2003, this accepted by OCCAR on 14 October 2003; Milestone 2 (launch of engine development) achieved 20 January 2004; landing gear selection 9 February 2004. First metal cut (in Germany) on 26 January 2005, with first powerplant run (engine and propeller combination) successfully accomplished at Istres, France, on 28 February 2006. Flight trials of engine/propeller combination to be undertaken on Hercules testbed modified by Marshall Aerospace at Cambridge, UK; this due to fly for first time in early 2007 and will perform approximately 200 hours of airborne testing.

Notable production-related events in 2006 included launch of wing fabrication at Filton in February, with final assembly of first wing beginning on 25 July in anticipation of delivery to Seville in first quarter of 2007; delivery of first rear fuselage section shells to Bremen by EADS Military Air Systems on 31 March; delivery of first fuselage components by TUSAS Aerospace Industries of Turkey in April; delivery of first fuselage top shells by Denel of South Africa in mid-year; start of integrated fuselage assembly process at Bremen on 24 July; transfer of first nose section by Airbus France from Méaulte to St Nazaire for installation of equipment (hydraulics, electrical systems, avionics and furnishings); and fitting out of first fuselage at Bremen from October. Major fuselage assemblies due to be virtually complete by end of 2006, with transfer to Seville scheduled to take place in early 2007, enabling final assembly to start in first quarter of that year.

Some 2,500 hours of developmental flight testing will be performed at EADS CASA's Seville plant and Airbus' Toulouse facility, with certification by a single authority; first six aircraft to be used for development, of which five will be refurbished and sold on completion of test duties, with final aircraft retained by Airbus Military as company-owned prototype. First aircraft to be delivered will be seventh A400M, scheduled for hand-over to French Air Force in October 2009. EADS CASA at Seville will have sole production line, assembling components supplied by partners in from Belgium, France, Germany, Malaysia, South Africa, Spain, Turkey and the UK.

A timetable of 56 months between contract and first flight has been agreed, with first delivery and IOC of a common configuration 'logistics' aircraft 77 months after contract signature. Maiden flight scheduled for early in 2008; deliveries to begin in October 2009. Production programme anticipates delivery of three aircraft in 2009, 17 in 2010, 27 in 2011, 26 in 2012 and about 28 per year thereafter. France and Turkey will be first to accept aircraft, with Germany and the UK receiving their first A400Ms in 2010; Spain following in 2011, Luxembourg in 2017 and Belgium in 2018. Final deliveries to original customers in 2021.

AIRBUS A400M EQUIPMENT SUPPLIERS

AAR Cargo Systems	Floor-based cargo loading system, aerial delivery system
AB Electronic Ltd	Halosensor drill position locator
AERNnova	Wing stringers
Aerofit, Inc	Fittings
Aerospace Display Systems, LLC	Electronic clocks
Aerosud Pty Ltd	Nose fuselage flexible lining, cargo hold lining, wing tip, cockpit linings, rigid bulkhead
Airbus Deutschland GmbH	Wing panels, centre fuselage, vertical tail plane box & assembly, flaps, rear fuselage assembly, fuselage furnishing, pre-final assembly line
Airbus SAS	Centre wing box, nose fuselage, nose landing gear bay, engine mounts, sponsons, rudder, wing fuselage fairing, cockpit furnishings
Airbus UK	Outer wing box, flaps
Air Liquide - Direction des Techniques	Onboard oxygen generating system
Alema Automation	Forward hatch
Alenia Aeronautica SpA	Aft fuselage
AOA Apparatebau Gauting GmbH	Fans, fuel pumps, smoke detection
Argosy International, Inc	Prepregs
ASG Luftfahrttechnik & Sensorik GmbH	Hand pump
Aries Complex, SA	Wing flap parts, wing fixed vane assembly
Astronautics Corp of America	Network server system
Axon Cable SAS	MIL-STD-1553 cable assemblies
BAE Systems (UK)	FADEC (with Hispano-Suiza)
Barry Controls Aerospace	Engine vibration isolators, APU mounts
B/E Aerospace Inc (Wellington)	Integrated passenger and crew oxygen system
Behr Industry GmbH & Co KG	Heat exchangers
Bell-Memphis, Inc	Control cable turnbuckles
Bohler Uddeholm Group	Leading edge titanium pylon forgings
Breeze-Eastern	Parachute line retrieval winch
Capewell Life Support/Aerial Delivery Systems	Aerial delivery platform, buffer stop assembly, tow plate
Castle Aero	Sponsons
CESA	Hydraulic reservoirs, including sensors, landing gear hydraulic equipment
Chelton (Electrostatics) Ltd	Static dischargers, tuneable V/UHF antenna, VDR antenna, IFF antenna, passive V/UHF antenna, Satcom
Cincinnati Machine	Composites machining equipment
Cobham Composites Ltd	Composites structures
Composite Industrie SA	Nose fuselage air conditioning ducts

Composites Technology Research Malaysia	Vertical tail plane trailing edge, vertical tail plane leading edge, horizontal tail plane trailing edge, nacelle extension fairing
Crane Aerospace/Hydro-Aire Inc	Braking & anti-skid control system
Crissair Inc	Check valves
Denel Aviation	Fuselage top-shells, carbon composites wing-fuselage fairing
Didsbury Engineering Co Ltd	Minilift hoist
Diehl Avionik Systeme	Doors control and monitoring system
DRS Electronic Warfare & Network Systems, Inc	Wideband wireless network
Dunlop Aircraft Tyres	
EADS CASA	Bias ply nose and main tyres
EADS Defence & Security Division	Horizontal stabiliser, flap track fairings, vertical tail plane leading and trailing edges, elevators, nacelles
EADS Socata	Digital map generator system, mission management computer, defensive aids computer
EADS Sogerma	Sponsons, nose landing gear doors
EADS Test & Services	Troop seats, cockpit seats
Eaton Aerospace, Fluid Power Division	Automatic test equipment
ECE	Reservoir filling and ground service panel
EIS Aircraft GmbH	Emergency power system contactors
Engelhard Corp	Troop seating
EUFA Europa Fasteners GmbH	Ozone converter
Europop International GmbH	Fasteners
Falgayras	TP400-D6 engines
Fastening Systems Intl, Inc	Windshield wiper system
Flight Refuelling Ltd	Blind rivet tooling
Froude Hofmann	Air refuelling system including Mk 908E wing pods and Mk 808E fuselage refuelling units
GKN Aerospace	Engine test stand
Goodrich Corporation, Power Systems	Metal and composites wing trailing edge subassemblies, composites wing spars, wing leading and trailing edge composites details and panels, aluminium alloy engine air inlet
Goodrich Corporation Sensor Systems	Main and auxiliary power unit electric generators (via Aerolec)
Goodrich Corporation Actuation Systems	SmartProbe air data system
Hamilton Sundstrand Electric Systems	Flap actuation package
Hamilton Sundstrand Power Systems	Secondary electrical power distribution centre, ram air turbine emergency power system
Hexcel Composites	APU
Hispano Suiza	Honeycomb and prepreg
HR Smith (Technical Developments) Ltd	Electrical wiring harnesses, electronic control unit, accessory gear box, control system integration, fuel pump, fuel metering unit, injectors
Hyde Aero Products Ltd	Antennas
Icore International Ltd	Wing leading edge metallic details
Indra Sistemas, SA	PTFE hoses
Intertechnique	Radar warning receiver
Johns Manville, Inc	Anti-ice system control unit, electrical functions software, hydraulic system monitoring unit, oxygen system control unit, fuel measurement and management system
KTN Kunststofftechnik Nobitz GmbH	Fibre glass insulation blankets and felt
Labinal	Centre fuselage air conditioning ducts
LASELEC SA	Non-ARINC avionics racks and relay boxes, nose fuselage and cockpit electrical harnesses
Latelec	UV laser wire and cable marking equipment
Leach International Europe SA	Avionics racks
Le Creneau Industriel	Primary electrical power distribution centre
Liebherr-Aerospace Lindenberg GmbH	Machine tools
Lomas Engineering Ltd	Primary flight control actuators, nacelle anti-ice system, bleed air and leak detection (with EADS CASA), air generation and temperature control systems/VCS/CPCS
MTI Leewood GmbH	Cutting tools
Magellan Aerospace Corp	Nose fuselage insulation
Magnaflux	Structural components
Magnolia Plastics, Inc	Zyglu fluorescent penetrant
Mecachrome SA	Epoxy syntactics
Meggitt Safety Systems Inc	Wing ribs
Mensor Corporation	Fire detection system
Messier Bugatti	Air data test sets
Messier-Dowty	Wheels and brakes, SLK (steering, landing & kneeling) systems
Microtecnica	Landing gear
MRC Bearings	Propeller control module
MS Composites	Engine and gearbox bearings
M Torres Disenos Industriales S A	Cockpit armoured protection
Nichols Airborne Division	Machine tools
NMB Minebea UK Ltd	Electric motor pumps
Nord-Micro AG & Co OHG	Spherical bearings
Norwich Aero	De-icing timer for propeller de-icing system
Olutex	Temperature & speed sensors
	Centre fuselage insulation

Omega Technologies, Inc	Fastener installation and removal tools, hole drilling and preparation tools
Otto Fuchs KG	Horizontal tail plane inner fitting forging
Pacific Scientific HTL/Kin-Tech Division	Fire extinguishing (engines)
Pall GmbH Luftfahrttechnik	Reservoir pressurisation unit and bleed air restrictor
Pall Aerospace	Filters
Parker Aerospace, Air & Fuel Division	Fuel tank inerting systems
Patria Aerostructures Oy	Vertical tail plane tip fairing
PFW Aerospace AG	Cargo handling system, structural floor and drainage system, aerial delivery system
PPG Aerospace Transparencies	Cockpit windows
Ratier Figeac	FH386 eight-bladed propeller system, trimmable horizontal stabiliser actuator
Rheinmetall Defence Electronics GmbH	Cargo hold loadmaster control system electronics
Rockwell Collins	Avionics full duplex ethernet, avionics communications router, direction finder, HF-9500 communications system, satcom
Rohde & Schwarz International GmbH	M3AR family software radios, EL/CRODAT 4-2 crypto units
Rotastat	Electric motors
RTI Intl Metals, Inc	Titanium
Saab Aerostructures	Crew door
Saab Avionics	High lift control computer
SABCA	Vertical tail plane stringers, flap master supports
Saft America Inc	Ultra low maintenance rechargeable nickel-cadmium batteries
Schroth Safety Products GmbH	Troop restraint systems
Sener Ingenieria & Sistemas SA	Horizontal stabiliser structural design
Sirio Panel SpA (via Tusas Aerospace)	LED lighting system, including cargo, service, external and emergency lights and power sources
Sirio Panel SpA	Integrated control panel system including integrated control panels, front face panels, lighting management units
Smiths Aerospace (Aerostructures)	In-flight refuelling probe
Smiths Aerospace Digital	ViDP video distribution & processing system
Sonaca SA	Wing fixed leading edges, main landing gear doors, leading edge cowlings, wing anti-icing system
Stratoflex Products Div	Flexible hoses and quick disconnect valves
TEAM	Passenger address system
Tech SAT GmbH	Core system of military test facility
Techspace Aero SA	Oil systems for TP400 engine
Techtest	Emergency locator transmitter
Teledyne Relays	Relays and switches
Thales Avionics Electrical Systems	Electrical power generation system
Thales Avionics SA	FMS400 flight management system, integrated modular avionics, FLIR, control and display system, incl interactive LCD screens, TACAN
Transport Dynamics Corp	Bearings
Tritech Precision Products Ltd	Machined and cast fuel connectors
Tusas Aerospace Industries	Forward centre fuselage, tailcone and top shell on rear fuselage, paratroop doors and hatch doors, ailerons and spoilers, interior and exterior lighting
Valley-Todeco, Inc	Bearings and bolts
Weston Aerospace Ltd	Sensor suite for TP400M engine

CURRENT VERSIONS: Primarily for carriage of military personnel and outsize cargoes such as helicopters, armoured fighting vehicles, trucks and 40 ft ISO containers. Also designed to provide full aerial delivery and tactical air land capability, particularly into soft, natural surface airstrips. Typical strategic air transport capability will be 30,000 kg (66,139 lb) payload over 2,400 n miles (4,445 km; 2,762 miles) with military reserves, or 20,000 kg (44,092 lb) payload over 3,450 n miles (6,389 km; 3,970 miles). A400M standard specification allows aircraft to be used in air-to-air refuelling (AAR) role with addition of underwing hose and drogue dispensing pods; alternatively, A400M can be modified to operate as a single-hose centreline refueller, with a pallet-mounted hose drum unit, secured to the closed rear ramp. Fuel load can be increased by installation of two additional tanks in cargo hold, up to total capacity of 11,375 kg (25,078 lb). With additional fuel tanks installed, an A400M could transfer 40,000 kg (88,185 lb) of fuel at a point 400 n miles (740 km; 460 miles) from base with loiter time of two hours. A400M speed envelope permits safe refuelling of fighter and large multi-engined aircraft, as well as helicopters. On an AAR mission, including two hours loiter on station at range of 500 n miles (926 km; 575 miles), A400M would have potential 'give-away' of about 35,000 kg (77,162 lb) and still retain sufficient fuel to return to base with normal reserves. Single-point AAR configuration can transfer fuel at rate of up to 1,800 kg (3,965 lb)/min; two-point configuration has maximum fuel transfer rate of 1,200 kg (2,646 lb)/min. In December 2005, France, Germany and Spain confirmed intent to purchase AAR kit for A400M from Flight Refuelling of UK; France and Germany will each receive 10 Mk 908E shipsets (20 pods), while Spain requires nine shipsets, France and Germany also to obtain Mk 808E centreline hose drum refuelling units, having signed for five and six respectively.

CUSTOMERS: See table. Procurement agency is OCCAR in Bonn, acting for all seven European launch countries. Average planned production capacity is 28 aircraft per year to meet demand from launch and subsequent export customers. Export market estimated at about



First Airbus A400M fuselage on completion of assembly at Bremen in September 2006 104071

450 aircraft over 25 years, with A400M expected to account for some 200 of this total. Most recent customer is Malaysia, which signed contract for four AAR-capable A400Ms in Langkawi on 8 December 2005; initial pair to be delivered in 2013, with remaining two following in 2014. To replace total of 14 C-130s, so further orders appear feasible. Chile had previously emerged as customer for three in mid-2005, but change of government in March 2006 resulted in review of plan and eventual abandonment. Australia and Canada both considered to be potential customers, but both opted to acquire Boeing C-17 Globemaster III.

A400M ORDERS (at November 2006)	
Country	Qty
Belgium	7
France	50
Germany	60
Luxembourg	1
Malaysia	4
South Africa	8
Spain	27
Turkey	10
UK	25
Total	192

COSTS: Total development cost expected to be around EUR5.5 billion. Unit price approximately EUR100 million for the Common Standard aircraft (2006).

DESIGN FEATURES: High-wing, T-tailed aircraft with rough-field landing gear and much larger cabin/hold floor area and cross-section than C-130/C.160, permitting high payload factors with low-density cargo, vehicles or mixed passenger/cargo loads. Use of propellers felt to be essential for steep tactical approaches to landing; hot-and-high airfield performance; adequate thrust-reverse performance for taxiing and short landing; for maximising power response; and for minimising FOD vulnerability. Long-range cruising speed of M0.68 to M0.72 up to 11,280 m (37,000 ft). Tactical mission parameters of low-level flight down to 150 m (500 ft) AGL in IMC in manual or automatic operation on predetermined route with civil standard of safety; 92 m (300 ft) night VMC in manual operation; 46 m (150 ft) day VMC in manual operation. Minimum service life 30,000 hours, including allowance for low-level flight and short-field performance. Optimised for autonomous deployment; Airbus Military offering 15-day away-from-base serviceability guarantee, all necessary support being within flight crew's capabilities.

Wing sweep 15° at 25 per cent chord; anhedral 4°; taper ratio 0.345; mean aerodynamic chord 5.671 m (18 ft 7 3/4 in). Tailplane sweep 32.5° at 25 per cent chord.

FLYING CONTROLS: Fly-by-wire, hydraulically powered; all control surfaces electrically signalled, adapted to military requirements and specific mission profiles; ailerons and elevator actuated by a hydraulic circuit, which powers one actuator, and an electrical circuit, which powers an electro-hydrostatic actuator; rudder actuated by two electrical back-up hydraulic actuators, each powered by one hydraulic circuit and one electrical circuit. Five spoilers and two-section fixed-vane flaps on each wing; tailplane trimmable by screw-jack. No slats. Spoilers used for roll control, lift dumping and as speed brakes.

STRUCTURE: Aluminium alloy, with titanium alloy in highly loaded areas (around windscreen, wing/fuselage joint and landing gear anchorage) and glass fibre or carbon fibre for lightly loaded components (landing gear doors and various fairings). Tailplane has aluminium alloy central joint and two outer composites box structures; elevator primary structure of carbon fibre. Constant-chord fin has two-spar (originally three-spar, but later changed) main box, trailing-edge shroud and single-piece rudder, all primarily of composites, plus hybrid metal/composites removable leading-edge. Rudder of carbon fibre, with aluminium, hinge-connecting ribs. Extensive use of carbon fibre composites in wing for skins, stringers, spars and moving surfaces; metal for ribs, fixed leading-edges, engine mountings and fuselage pick-ups. Front spar at 15 per cent chord; composites rear spar at 62.5 per cent chord. Modern design and manufacturing techniques expected to afford major reductions in maintenance man-hour requirements and increases in aircraft availability/survivability.

LANDING GEAR: Retractable Messier-Dowty tricycle type with sufficient 'floatation' for semi-prepared and/or unsurfaced runways. Each main unit has six wheels in tandem pairs, retracting rearwards into fairings on fuselage sides. Each pair of mainwheels has independent, lever-type shock-absorbers. Mainwheel tyres, size 43x15.5-17, pressure 8.83 bar (128 lb/sq in). Twin nosewheels retract forwards. Nosewheel tyres, size 37x14.0-14, pressure 7.86 bar (114 lb/sq in). Emergency gravity extension of all units. Multidisc carbon brakes on mainwheels can operate differentially to assist steerable nosewheel in ground manoeuvring. Turning radius: landing gear 15 m (50 ft); wingtip 28.6 m (94 ft). Operable from CBR4 soft field. Mainwheels can 'kneel' for loading and unloading of large tracked and wheeled vehicles. Hydraulic strut at rear of each sponson supports and stabilises aircraft during loading and unloading.

POWER PLANT: Choice initially settled on three-shaft 7,457 to 9,694 kW (10,000 to 13,000 shp) turboprop TP400 developed by Fiat Avio, ITP, MTU, Rolls-Royce, SNECMA and

For details of the latest updates to *Jane's All the World's Aircraft* online and to discover the additional information available exclusively to online subscribers please visit
jawa.janes.com

Techspace Aero, although this also rejected in February 2002 on basis of being too costly and too heavy as well as insufficiently powerful. Engine competition subsequently re-opened, with European and Canadian manufacturers submitting proposals. Airbus announced engine decision 6 May 2003, when EuroProp International (ITP, MTU, Rolls-Royce and Snecma) TP400-D6 selected in preference to Pratt & Whitney Canada PWC180.

Each engine provides 9,694 kW (13,000 shp) thermodynamic power de-rated to 8,203 kW (11,000 shp) for take-off. Engine has a three-shaft configuration, an offset gearbox and dual-channel FADEC with propeller control. Engines are 'handed', with one of each wing pair rotating in opposite direction to the other, offering reduction in torque and elimination of asymmetric airflow over wing. This 'down between' engine configuration also improves asymmetric handling in event of one engine becoming inoperative.

Eight-blade FH386 composites curved propellers to be supplied by Ratier-Figeac/Hamilton Sundstrand. Propeller tip speed 290 m/s (951 ft/s) at M0.68, 842 rpm maximum speed for take-off. Composites blades with integral de-icing blankets. Full reversal of pitch will allow aircraft to turn up 2° slope at MTOW on concrete surface (1° on soft surface). Adjacent propellers turn in opposite directions to produce DBE (down between the engines) airflow. Viewed from rear Nos.1 (port outer) and 3 (stdb inner) turn clockwise; Nos. 2 and 4, anticlockwise. Advantages comprise more symmetric airflow, weight savings, reduced wing loading, increased (4 per cent) and better lift distribution, quieter cargo bay, better OEI handling, and reduced empennage area (fin 17 per cent; horizontal tail 12 per cent).

Ultra Electronics Tuned Vibration Absorber System (TVAS) active noise and vibration control system to be installed; this entails fitment of 200 active vibration absorbers to fuselage and central electronic control unit.

Fuel capacity 64,000 litres (16,907 US gallons; 14,078 Imp gallons) in seven tanks (one tank per engine, one transfer tank per wing, one centre tank); electric pumps and valves all mounted outside tanks. Detachable in-flight refuelling probe. Provision for inert gas system; provision for Flight Refuelling Mk 908E wing-mounted refuelling pods; optional Mk 808E hose drum unit (HDU) in cargo hold; and up to two optional additional fuel tanks, totalling up to 14,400 litres (3,804 US gallons; 3,168 Imp gallons), in fuselage. Any standard A400M can be converted to a tanker within two hours. Pressure refuelling, with gravity back-up.

ACCOMMODATION: Two-man, NVG-compatible flight deck with dual sidestick controllers and additional optional forward-facing workstation for third 'mission crew member' to assist with tactical and special tasks, when required. View from flight deck exceeds JAR 25 and MIL-STD-850B. Provision for bulletproof flight deck windows, 68 mm (2 3/4 in) thick, and armour protection around crew's and loadmaster's seats. Loadmaster station forward of and overlooking cargo area. Two commercial standard unisex lavatories in lower deck, starboard, front; two fixed, screened urinals and fixed hand-basin, starboard, rear. Flight crew rest area with two foldaway bunks; seat for fourth occupant on left, in front of bunks, with fifth seat as part of right-hand side of the bunk.

Two passenger doors forward; two rear. Forward, port, for normal access; forward, starboard, for emergency exit; rear doors for paratroop dropping. Two lateral sliding windows in cockpit equipped with rope for emergency evacuation of flight deck; two emergency exit hatches in front and rear roof for flight crew and passengers. Cargo door, hinged at aft end, raised hydraulically to hold roof for loading via rear ramp. Optional closed-circuit TV surveillance of cargo hold, with imagery selectable on flight deck displays.

Cargo floor with 238 tiedown rings capable of holding 11,340 kg (25,000 lb) loads; 10 tiedown rings capable of holding 11,340 kg (25,000 lb) loads on forward part of ramp; and 46 tiedown rings capable of holding 4,536 kg (10,000 lb) loads on the ramp. A400M loads can include M113, Warrior or LAV-III armoured vehicles; Super Puma or NH90 or two Tiger or Apache helicopters; nine pallets (88 x 108 in military or 88 x 125 in civil); plus 54 troops and second loadmaster on permanent (tip-up) sidewall seats; two 20 ft ISO containers; Patriot SAM system; six light trucks with trailers; 66 stretchers and 25 medical attendants available as optional medical evacuation configuration; or 116 armed troops or paratroops on sidewall and removable centreline seats.

SYSTEMS: FBW FCS derived from Airbus airliners, including sidestick controllers (left hand for captain, right hand for co-pilot, with conventional central power-lever throttle quadrant). Electrical power provided by four variable frequency generators, each of 75 kVA. Additional power from three-phase generator on APU (90 kVA, A320 type, with in-flight restart capability) in right-hand side of rear wing fairing; three-phase generator on RAT; emergency battery; and external power receptacle. DC power from three 300 A battery charger rectifier units (BCRU) and one transformer/rectifier unit (TRU); two BCRU feed separated, main DC busbars and charge two batteries; one BCRU feeds the 'flight essential' busbar and the emergency busbar and charges the emergency battery; and one TRU feeds the APU starting system. Three Ni/Cd batteries are additional source for DC power.

Two hydraulic systems, Blue and Yellow, each operating at 207 bar (3,000 lb/sq in). Blue (driven by Nos. 1 and 2 engines) powers port aileron and elevator, spoilers on each wing, RAT retraction, normal and parking brakes, cargo ramp, cargo door, toes, sponson step, air deflector and ground stabiliser struts. Yellow (Nos. 3 and 4 engines) responsible for starboard aileron and elevator, spoilers on each wing, alternate brake, nosewheel steering,

landing gear, landing gear doors and kneeling/raising. Both systems power flaps, flap wing tip brakes, rudder and trimmable horizontal stabiliser. Each system has 140 litre (37.0 US gallon; 30.8 Imp gallon)/min engine-driven pump and 40 litre (10.6 US gallon; 8.8 Imp gallon)/min alternate current motor pump; power transfer unit between systems for emergency use. Actuation by Moog.

Pneumatic system for air conditioning and pressurisation: wing and engine air intake anti-icing; engine starting; and pressurisation of other onboard systems. Two computers control four engine air bleed units. Interior divided into three air conditioning zones; one for flight deck and two in cargo hold. Cabin pressure altitude 2,440 m (8,000 ft) when flying at 11,280 m (37,000 ft).

Aircraft lighting compliant with JAR 25 and with Type II, class B, NVG operation. External lighting allows covert military operation during all flight phases, including in-flight refuelling.

Cargo handling system operated by single loadmaster, managed via loadmaster work station (LMWS), which interfaces with aerial delivery system, military mission management system, electronic instrument system, weight and CG computation, load and delivery planning and cargo loads database update.

The aircraft integrated monitoring and diagnostic system (AIMDS) provides support for A400M line maintenance and servicing, as well as for updating of databases and software of on-board avionics systems. Interaction and data exchange with avionics systems is organised around a network server system (NSS) architecture, which hosts several applications. These include the central maintenance system (CMS) which collects maintenance data and aids the maintenance operator in assessment of origin of failures. Many avionics systems constantly monitor their own status and relay it to the CMS for recording, allowing this information to be used to generate reports according to the different failure messages. CMS also enables ground operators to perform status tests of specific avionics systems on request for troubleshooting purposes. A data loading and configuration system (DLCS) maintains an up-to-date record of aircraft hardware/software configuration and allows operators to update databases and software of many avionics systems. The aircraft condition monitoring system (ACMS) provides usage and life monitoring data for engines, propellers, APU and environmental control system packs. Finally, the structural lifetime monitoring system (LTMS) is an optional item of equipment which can collect information on airframe fatigue condition and provide hard landing detection and local limit load monitoring. Authorised AIMDS users, including crew members, maintenance technicians and security/electronic warfare officers, can access it for maintenance purposes or to load/offload mission-related data using an aircraft multipurpose access terminal (AMAT) in the cockpit or a portable multipurpose access terminal (PMAT) connected to one of five ports fitted at various locations around the aircraft, with all operations being recorded and linked to the operator, who must use a dedicated PIN (personal identification number) when accessing the system.

AVIONICS: *Comms:* HF and V/UHF with COMSEC capability, SELCAL and optional Inmarsat SATCOM. Audio management system, wireless intercom system, cockpit voice recorder and passenger address system. ELT and IFF transponder.

Radar: Weather/navigation radar, with indication of turbulence and windshear; replaceable by optional military radar with ground mapping mode.

Flight: Three inertial platforms with embedded air data systems. VOR, DME, Tacan, ADF (optional), multimode receiver (ILS, MLS and GNSS), military GPS, two radar altimeters, ATC transponder. Enhanced-GPWS and TCAS. Digital terrain-referenced navigation system, future air navigation system (FANS A), tactical ground collision avoidance system (T-GCAS), FLIR-enhanced vision system, terrain masking low level flight system, Cat IIIA automatic landing capability and formation keeping system as options. Thales developing tactical air navigation and enhanced infra-red vision system (EVS), with imagery from latter to be presented on HUD.

Instrumentation: Two digital wide-angle HUDs; eight identical full-colour 152x 203 mm (6 x 8 in) head-down displays (HDDs); two keyboard devices and two cursor control devices (CCDs); a ninth identical HDD, a third keyboard device and a third CCD as options for a third crew member.

Mission: Two flight management computers and two military mission management computers; optional MIDS tactical datalink.

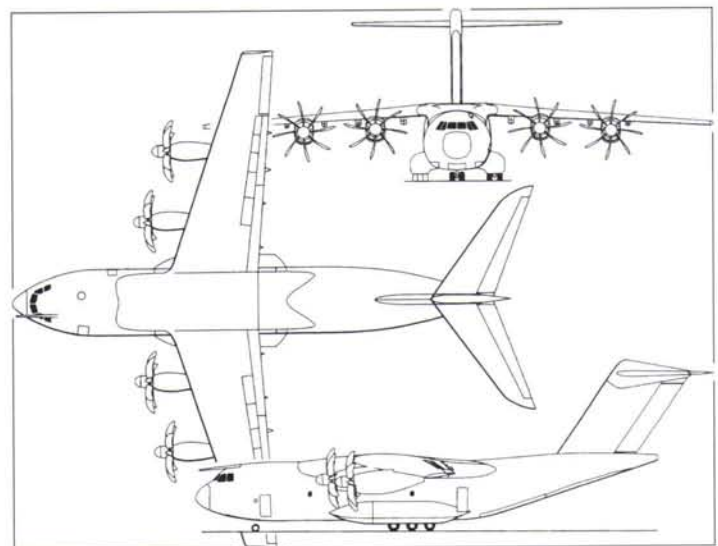
Self-defence: Modular defensive aids subsystem (DASS) with optional elements including central computer, RWR, MWS (passive/active), LWR, expendable dispensing system (chaff/flare), direct energy infra-red countermeasures (DIRCM) and towed radar decoy. EADS Defence Electronics and Thales jointly developing Multi-Colour Infra-Red Alerting Sensor (MIRAS) missile warning system for A400M.

EQUIPMENT: Loadmaster work station, eight medical evacuation stretchers, four life rafts, short deployment kit, Breeze-Eastern cargo winch with 32,000 kg (70,548 lb) pull capacity at forward end of cargo hold, removable in-flight refuelling probe, centralised built-in test equipment, aircraft multipurpose access terminal; all supplied as standard equipment.

Optional equipment includes OBIGGS fuel tank inerting system, armouring kit for protection of flight-deck and loadmaster workstation, armour cockpit windshield and side windows kit, Breeze-Eastern 5-tonne power crane in roof above cargo ramp, bi-directional powered rollers, cargo bay fuel tanks, third crew member work station, structural lifetime monitoring system, central guidance vertical restraint device to permit aerial delivery of two rows of 1.22 m (4 ft 0 in) wide CDS containers, equipment for full medical evacuation role, seat pallets and video cameras to monitor cargo hold, aerial delivery and in-flight refuelling.

DIMENSIONS, EXTERNAL:

Wing span	42.36 m (138 ft 1 1/4 in)
Wing chord: at root	7.36 m (24 ft 1 3/4 in)
at tip	2.54 m (8 ft 4 in)
Wing aspect ratio	8.1
Length: fuselage	39.09 m (128 ft 3 in)
overall	45.10 m (147 ft 1 1/2 in)
Height overall	14.68 m (48 ft 2 in)
Wheel track (mean)	6.22 m (20 ft 4 3/4 in)
Wheelbase: mean	13.29 m (43 ft 7 1/4 in)
front	11.76 m (38 ft 7 in)
rear	14.82 m (48 ft 7 1/2 in)
Propeller diameter	5.335 m (17 ft 6 in)
Cargo ramp: Length	5.84 m (19 ft 2 in)
Width	4.00 m (13 ft 1 1/2 in)
Height to sill	1.60 m (5 ft 3 in)
Cargo door: Length	7.76 m (25 ft 5 1/2 in)
Crew door: Length	1.46 m (4 ft 9 1/2 in)
Width	0.79 m (2 ft 7 in)
Emergency door: Length	1.22 m (4 ft 0 in)
Width	0.76 m (2 ft 6 in)
Height to sill	1.60 m (5 ft 3 in)
Paratroop door: Length	2.10 m (6 ft 10 3/4 in)
Width	0.90 m (2 ft 11 1/2 in)
Height to sill	1.60 m (5 ft 3 in)



1158979 Airbus Military A400M military transport in production configuration (Paul Jackson)

DIMENSIONS, INTERNAL:	
Hold: Length excl ramp	17.71 m (58 ft 1¼ in)
Length of ramp	5.40 m (17 ft 8½ in)
Width at floor, continuous	4.00 m (13 ft 1½ in)
Height: forward of wing box	3.85 m (12 ft 7½ in)
aft of wing box	4.00 m (13 ft 1½ in)
Floor area: incl ramp	92.4 m² (995 sq ft)
Volume: incl ramp (approx)	356 m³ (12,570 cu ft)
excl ramp (approx)	274 m³ (9,680 cu ft)
AREAS:	
Wing, gross	221.50 m² (2,384.2 sq ft)
Ailerons (each)	3.94 m² (42.41 sq ft)
Flaps (per wing)	20.24 m² (217.86 sq ft)
Spoilers (per wing)	6.90 m² (74.27 sq ft)
Fin	46.43 m² (499.8 sq ft)
Tailplane	67.00 m² (721.2 sq ft)
Elevators (total)	11.49 m² (123.68 sq ft)
WEIGHTS AND LOADINGS:	
Operating weight empty	76,500 kg (168,655 lb)
Max payload: logistic 2.25g	37,000 kg (81,571 lb)
tactical 2.5g	30,000 kg (66,139 lb)
Max T-O weight: logistic 2.25g	136,500 kg (300,925 lb)
tactical 2.5g	127,500 kg (281,100 lb)

Max landing weight: logistic 2.25g	120,000 kg (264,550 lb)
tactical 2.25g	113,000 kg (249,125 lb)
Max zero-fuel weight: logistic 2.25g	113,500 kg (250,225 lb)
tactical 2.5g	106,500 kg (234,800 lb)
Max wing loading: logistic 2.25g	616.3 kg/m² (126.21 lb/sq ft)
tactical 2.5g	575.6 kg/m² (117.90 lb/sq ft)
Max power loading: logistic 2.25g	4.16 kg/kW (6.84 lb/shp)
tactical 2.5g	3.97 kg/kW (6.38 lb/shp)
PERFORMANCE (estimated):	
Max operating speed and Mach No. (VMO/MMO)	... M0.72 (300 kt; 555 km/h; 345 mph)
Normal cruising Mach No.	0.68
Airdrop speed	125–200 kt (232–370 km/h; 144–230 mph)
Max rate of climb at S/L	1,219 m (4,000 ft)/min
Cruise ceiling: normal operations	11,280 m (37,000 ft)
special operations	12,192 m (40,000 ft)
Logistic mission range at long-range cruise speed; reserves as per MIL-C-5011B (5% trip fuel and 30 min hold at 445 m (1,500 ft))	
with 30,000 kg (66,139 lb) payload	2,400 n miles (4,444 km; 2,761 miles)
with 20,000 kg (44,092 lb) payload	3,450 n miles (6,389 km; 3,970 miles)
Ferry range	4,750 n miles (8,797 km; 5,466 miles)

ATR
AVIONS DE TRANSPORT REGIONAL INTEGRATED

1 allée Pierre Nadot, F-31712 Blagnac Cedex, France
Tel: (+33 5) 61 21 62 21
Fax: (+33 5) 61 21 63 18
Web: www.ATRaircraft.com
CHAIRMAN: Jean-Michel Léonard
CEO: Filippo Bagnato
SENIOR VICE-PRESIDENTS:
John Moore (Commercial)
Luigi Lombardi (Operations)
Jean-Pierre Cousserans (Customer Services)
Serge Queille (Finance)
DIRECTOR, COMMUNICATIONS AND PRESS RELATIONS: Frédéric Lahache

PARTICIPATING COMPANIES
Alenia Aeronautica: Italy
EADS: International



ATR reinforced flight deck door 1158863

First Aerospatiale/Aeritalia (later Alenia) agreement July 1980; ATR programme started 4 November 1981; Groupement d'Intérêt Economique (50:50 joint management company) formally established 5 February 1982 to develop ATR series of transport aircraft. ATR became a single corporate entity on 1 June 2001 with the formal establishment of ATR Integrated combining the activities of the two partners, still with GIE status and around 500 employees. Holding is 50 per cent each. Workforce 570 in December 2004. Revenue for 2005 was USD469 million, compared with USD543 million in 2004.
Assembly or licensed production by Xian Aircraft in a new factory at Shenzhen, near Hong Kong, was discussed, but not pursued; Xian already produces rear fuselage components for ATR. Fuselage and wing production remain subcontracted to Alenia Aeronautica and EADS Sogerma (for Airbus France) respectively, though Alenia planning in mid-2006 to transfer some manufacturing work to Romaero in Romania.
ATR marketing and support office opened in Washington 15 July 1986; ATR airline support centre in Singapore opened 18 November 1988; ATR Training Centre (ATC) opened in Toulouse 1 July 1989; these functions taken over by Al(R) from 1996, but returned when this joint venture with BAe was dissolved on 1 July 1998. Second ATC, in Bangkok, opened in 1997. Beijing office opened in September 2003. Phased production lines introduced in 1999 have reduced delivery times to three months from one year. The 600th ATR was delivered to Air Dolomiti on 28 April 2000 and 700th to Air Deccan on 8 September 2006. Toulouse and Washington distribution centres to be relocated in 2006 to Paris (Roissy) and Miami respectively. ATR's Asset Management arm is responsible for second-hand sales.
The ATR family logged its 10 millionth flight on 10 October 2000. Sales by 30 September 2006 totalled 401 ATR 42s and 433 ATR 72s, or 834 in all, of which 699 (385 ATR 42s and 314 ATR 72s) had been delivered by 12 July 2006 to 125 operators in 73 countries, including 2005 deliveries of five and 10 respectively. Including 48 second-hand aircraft, ATR delivered 63 aircraft in 2005 compared with 62 in 2004. Worldwide fleet of cargo versions totalled 66 at 1 January 2006, including 33 in North America and 24 in Europe. Orders and options for the first half of 2006 totalled 47 and 25 respectively for a 130-aircraft backlog. Output for the year was predicted at 26 aircraft, with 44 planned in 2007 and about 55 in 2008. Of the overall total orders, 349 (111 ATR 42s and 238 ATR 72s) are of the -500 series, from 102 customers.
In 2002, ATR developed a modified internal door designed to resist unauthorised flight deck incursions, in anticipation of the FAA's 9 April 2003 deadline for all airliners to be retrofitted to this standard. By mid-2002, ATR had received 100 firm orders for the modified door from American Eagle (first customer), Finnair, Jet Airways and Trans States Airlines. The new door is resistant to forcible impacts of up to 300J and penetration of 9 mm and 44 Magnum ammunition. Total of 260 doors sold by October 2004.

ATR 42
TYPE: Twin-turboprop airliner
DEVELOPMENT MILESTONES

42	
Programme launched	4 Nov 81
First flight	16 Aug 84
Certification	24 Sep 85
First delivery	3 Dec 85
42-500	
Programme launched	14 Jun 93
First flight	16 Sep 94
Certification	28 Jul 95
First delivery	31 Oct 95

PROGRAMME: Joint launch by Aerospatiale (now in EADS) and Aeritalia (now Alenia) in November 1981, following June 1981 selection of P&WC PW120 turboprop as basic power plant; first flights of two prototypes 16 August 1984 (F-WEGA) and 31 October 1984 (F-WEGB); first flight production aircraft 30 April 1985; simultaneous certification to JAR 25 by France and Italy 24 September 1985, followed by USA (FAR Pt 25) 25 October 1985, Germany 12 February 1988, UK 31 October 1989; deliveries began 3 December 1985 to Air Littoral. Certified with large cargo door 2003; launch customer Northern Air Cargo of Alaska.
Series 500, with 'new look' interior, announced at Paris Air Show 14 June 1993; first flight F-WWEZ (c/n 443) 16 September 1994; French and UK certification 28 July 1995; first delivery (F-OHIF to Air Dolomiti) 31 October 1995. FAA certification 13 May 1996.
CURRENT VERSIONS: ATR 42-300: Initial version; entered service 1985; phased out of production in 1996. Two Pratt & Whitney Canada PW120 turboprops, each flat rated at 1,342 kW (1,800 shp) for normal operation and 1,492 kW (2,000 shp) OEI; Hamilton Sundstrand 14SF four-blade constant-speed fully feathering and reversible-pitch propellers.
ATR 42-320: Identical to 42-300 except for optional 1,566 kW (2,100 shp) PW121 engines for improved hot/high performance; OWE increased/payload decreased by 5 kg (11 lb). Entered service 1987; phased out in 1996.
ATR 42-400: P&WC PW121A engines with six-blade Hamilton Sundstrand 568F propellers; maximum cruising speed 266 kt (493 km/h; 306 mph); maximum range 825 n



An ATR 42-500 of Air Caledonie

1158867

miles (1,527 km; 949 miles) with full payload. First flight 12 July 1995 (F-WWEF/OK-AFE); two Srs 420s ordered for CSA, and both delivered 14 March 1996, having received DGAC certification on 27 February. No further civil aircraft.

ATR 42-500: Principal ATR 42 version from 1995. Compared with Series 300, has more powerful engines and six-blade propellers, reinforced wings to allow greatly increased cruising speed and higher weights; all systems improvements of ATR 72, including flight management computers; cockpit, elevators and fin from ATR 72-210; strengthened landing gear; electrically operated main doors; reinforced fuselage and wing centre-section.

Description applies to ATR 42-500, except where indicated.

ATR 42 Quick-Change: (formerly Tube previously Cargo QC) Quick-change interior to hold nine containers. Available as new-build or retrofit. Cabin equipped with smoke detectors, air distribution shut-off valve and modifications necessary for certification for full freighter operations. Conversion takes about 30 minutes. Launch customer, DHL Aviation of South Africa, received first of two converted -300s in October 2000.

ATR 42 full freighter version: Fully dedicated freight transport version (bulk, containers or pallets). Various conversions available, including 'Tube' and/or large cargo door (LCD). Full freighter version available with Alenia Aeronautica STC.

'Tube' package offered by Aeronavali includes E-class cabin compartment with floor reinforced to 400 kg/m² (82 lb/sq ft). Total volume for cargo is 56 m³ (1,978 cu ft); max payload 5,883 kg (12,970 lb). Parallel cabin section 10.25 m (33 ft 7½ in) long and tapered section 4.47 m (14 ft 8 in) long, with positions for up to four spider nets. MTOW in this configuration is 16,900 kg (37,258 lb); MLW 16,400 kg (36,156 lb); MZFW 15,540 kg (34,260 lb). Other 'Tube' modifications by independent outfitters also available.

LCD installation is part of the STC, and provides a 2.94 × 1.80 m (9 ft 7¾ in × 5 ft 10¼ in) upward-opening cargo door on port side at front to permit loading of three 224 × 274 cm (88 × 108 in) pallets or five LD3 containers. Max payload for an ATR 42 fitted with both 'Tube' and LCD is 5,300 kg (11,684 lb). First such retrofit, for Northern Air Cargo, took place in 2003.

ATR 42 F: Military/paramilitary freighter with modified interior, reinforced cabin floor, port-side cargo/airdrop door can be opened in flight; can carry 3,800 kg (8,377 lb) of cargo or 42 passengers over 1,250 n miles (2,315 km; 1,438 miles). One delivered to Gabon 1989.

ATR Calibration: Projected navaid calibration version.

ATR 42 L: Projected freighter with lateral cargo door; available as ATR 42 Large Cargo Door (see above).

ATR 42 Météo: One second-hand ATR 42-300 (F-HMTO) converted for (and financed almost entirely by) Météo France, the French meteorological organisation. Conversion undertaken by EADS Sogerma Services, to whom aircraft delivered in September 2002. Modification between March and December 2003; qualification flight testing throughout 2004; delivered to customer July 2005 and expected to enter service by early 2006. Intended as major scientific research asset (Safire programme), with functions including atmospheric pollution measurement, ice crystal photography, solar radiation analysis and ocean wave height measurement. Airframe changes included addition of 70 external attachment points for scientific sensors, extra ports in fuselage underside and an 80 kg (176 lb) capacity pylon for a particle measurement instrumentation system under each wing, mid-way between engine and tip. The PW120 engines were upgraded to ATR42-320 standard. Internally, accommodation was provided for up to seven scientists and up to 25 kVA of additional electrical power for their instruments. Total scientific payload 2,500 kg (5,512 lb). Aircraft acquired for EUR4 million; modification programme cost a further EUR8 million.

ATR 42 MP Surveyor: Maritime and rescue version; *described separately*.

CUSTOMERS: Total 401 firm orders, of which 385 delivered, by 12 July 2006. Four ordered and 10 delivered in 1998; 14 ordered and 12 delivered in 1999; six (plus four options) sold in 2000; five (all -500s) delivered in 2001 and five in 2002. Ten -500s ordered and three delivered in 2003; one by Air Tahiti in May 2004. Seventeen -500s ordered in 2005 by FinnComm Airlines (eight), Air Madagascar (one), Air Caledonie (one) and Pakistan International (seven); five (all -500s) delivered, to CSA (four) and FinnComm (one).

COSTS: ATR 42-500: development cost USD50 million; unit price USD14.2 million (2004). **DESIGN FEATURES:** Designed to JAR 25/FAR Pt 25; high wing of medium aspect ratio, with constant-chord centre section and tapered outer panels; T-type tail with tapered tailplane and sweptback fin and fillet; pannel-mounted main landing gear.

Wing section Aerospatiale RA-XXX-43 (NACA 43 series derivative); thickness/chord ratio 18 per cent at root, 13 per cent at tip; constant-chord, no-dihedral centre-section with 2° incidence at root; outer panels 3° 6' sweepback at quarter-chord and 2° 30' dihedral.

FLYING CONTROLS: Conventional and manual. Lateral control assisted by single spoiler surface ahead of each outer flap; each aileron has electrically actuated trim tab; fixed incidence tailplane; horn-balanced rudder and elevators, each with electrically actuated trim tab; two-segment double-slotted flaps on offset hinges with Ratier-Figeac hydraulic actuators. Flap settings 0, 15, 25 and 35°.

STRUCTURE: Two-spar fail-safe wings, mainly of aluminium alloy, with leading-edges of Kevlar/Nomex sandwich; wing top skin panels aft of rear spar are of Kevlar/Nomex with carbon reinforcement; flaps and ailerons have aluminium ribs and spars, with skins of carbon fibre/Nomex and carbon/epoxy respectively; fuselage is fail-safe stressed skin, mainly of light alloy except for Kevlar/Nomex sandwich nosecone, tailcone, wing/body

fairings, nosewheel doors and main landing gear fairings; fin (attached to rearmost fuselage frame) and tailplane carbon structure; CFRP/Nomex sandwich rudder and elevators; dorsal fin of Kevlar/Nomex and GFRP/Nomex sandwich; engine cowlings of CFRP/Nomex and Kevlar/Nomex sandwich, reinforced with CFRP in nose and underside; propeller blades have metal spars and GFRP/polyurethane skins.

EADS France originally responsible for design and construction of wings and engine nacelles, flight deck and cabin layout, installation of power plant, flying controls, electrical and de-icing systems, and final assembly and flight testing of civil passenger versions; wing manufacture and testing reallocated to EADS Sogerma at Bordeaux from late 2001. Alenia Aeronautica builds fuselage and tail unit, installs landing gear, hydraulic system, air conditioning and pressurisation systems. ATR 42/72 manufactured at St Nazaire and Nantes (France), Pomigliano d'Arco and Capodichino (Italy), and assembled in Toulouse.

LANDING GEAR: Hydraulically retractable tricycle type, of Messier-Dowty trailing-arm design, with twin wheels and oleo-pneumatic shock-absorber on each unit. Nose unit retracts forward, main units inward into fuselage and large underfuselage fairing. Goodrich wheels and multiple-disc mainwheel brakes and Hydro-Aire anti-skid units. Mainwheel tubeless tyres, size 32×8.8R16 (10/12 ply), pressure 8.69 bar (126 lb/sq in) or H34×10.0R16 (14 ply). Nosewheel tubeless tyres, size 450×190-5 (10 ply), pressure 4.34 bar (63 lb/sq in) or 450×190R5 (10 ply). Minimum ground turning radius: at nosewheel 10.14 m (33 ft 3½ in); at mainwheel 8.26 m (27 ft 1¼ in); at wingtip 17.40 m (57 ft 1 in).

POWER PLANT: Two 1,790 kW (2,400 shp) Pratt & Whitney Canada PW127E turboprops; ATR 72-210 nacelles; six-blade Ratier-Figeac/Hamilton Sundstrand 568F propellers with new electronic control giving faster response and better synchrophasing (as for ATR 72-500 from 1996). Propeller brake on starboard engine to enable engine to be used as auxiliary power unit for internal air conditioning.

Fuel in two integral tanks in spar box, total capacity 5,736 litres (1,515 US gallons; 1,262 Imp gallons). Single pressure refuelling point in starboard wing leading-edge. Gravity refuelling points in wing upper surface. Oil capacity 40 litres (10.6 US gallons; 8.8 Imp gallons).

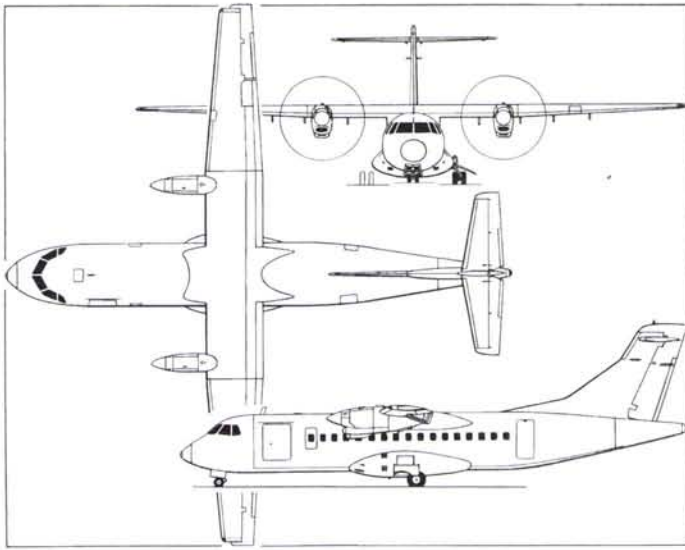
ACCOMMODATION: Crew of two on flight deck; folding seat for observer. Seating for 42 passengers at 84 cm (33 in) pitch; or 46, 48 (standard) or 50 passengers at 76 cm (30 in) pitch; compared with Series 300, ATR 42-500 has completely new interior with new ceiling and sidewalls, indirect lighting, more sound damping; call buttons and reading lights relocated; overhead bins lengthened to 2 m (6 ft 6¾ in) to accommodate skis, golf clubs and fishing equipment carried as hand baggage. Further option of restyled 'Elegance' cabin furnishing introduced in mid-2003 for new aircraft or as retrofit. Baggage volume increased by 40 per cent. Corporate version also available; executive seating for eight to 24 passengers plus lounge area. Active noise control system, previously offered as an option, is no longer available. Instead, ATR 42-500s have structural acoustic treatment comprising reinforcement of seven fuselage frames adjacent to the propeller plane; dynamic vibration absorbers in this area; and internal aluminium skin damping material forward and aft of wing.

Passenger door, with integral steps, at rear of cabin on port side. Front baggage/cargo compartment between flight deck and passenger cabin, with access from inside cabin and separate loading door on port side; lavatory, galley, wardrobe and seat for cabin attendant at rear of passenger cabin, with service door on starboard side; rear baggage/cargo compartment aft of passenger cabin; additional baggage space provided by overhead bins and underseat stowage. Entire accommodation, including flight deck and baggage/cargo compartments, pressurised and air conditioned. Emergency exit via rear passenger and service doors, and by window exits on each side at front of cabin.



Current 'Elegance' passenger accommodation of ATR family

1158868



ATR 42 twin-turboprop regional transport (Dennis Punnett)

1158759

SYSTEMS: Improved in parallel with development of ATR 72; following refers to baseline aircraft. Honeywell air conditioning and Softair pressurisation systems, utilising engine bleed air. Pressurisation system (nominal differential 0.41 bar; 6.0 lb/sq in) provides cabin altitude of 2,040 m (7,000 ft) at altitudes up to FL250.

Two independent hydraulic systems, each at pressure of 207 bar (3,000 lb/sq in), driven by electrically operated Abex pump and separated by interconnecting valve controlled from flight deck; system flow rate 7.9 litres (2.09 US gallons; 1.74 Imp gallons)/min; one system actuates wing flaps, spoilers, propeller brake, emergency wheel braking and nosewheel steering; second system for landing gear and normal braking. Kléber-Colombes pneumatic system for de-icing of wing leading-edges, tailplane leading-edges and engine air intakes; noses of aileron and elevator horns have full-time electric anti-icing.

Main electrical system is 28 V DC, supplied by two Auxilec 12 kW engine-driven starter/generators and two Ni/Cd batteries (43 Ah and 15 Ah), with two solid-state static inverters for 115/26 V single-phase AC supply; 115/200 V three-phase supply from two 20 kVA frequency-wild engine-driven alternators for anti-icing of windscreen, flight deck side windows, stall warning and airspeed indicator pitots, propeller blades and control surface horns. Eros/Puritan oxygen system. Instead of APU, starboard propeller braked and engine run to give DC and 400 Hz power, air conditioning and hydraulic pressure.

AVIONICS: Rockwell Collins com/nav equipment. Improved in parallel with development of ATR 72; following refers to baseline aircraft. For ATR 42-500, see ATR 72-500 description.

Comms: CVR, PA system.

Radar: Honeywell P-660 weather radar.

Flight: Honeywell DFZ 600 AFCS; AZ-800 ADCs; AH 600 AHRS with avionics standard communication bus; Hamilton Sundstrand GPWS; L-3 digital FDR; Rockwell Collins DME; Honeywell FMZ-800 flight management system and dual GPS receivers installed in four Continental Airlines ATR 42s to allow autonomous approaches.

Instrumentation: EZ-820 electronic flight instrument system.

DIMENSIONS, EXTERNAL:

Wing span	24.57 m (80 ft 7½ in)
Wing chord: at root	2.57 m (8 ft 5¼ in)
at tip	1.41 m (4 ft 7½ in)
Wing aspect ratio	11.1
Length overall	22.67 m (74 ft 4½ in)
Fuselage max width	2.865 m (9 ft 4½ in)
Height overall	7.59 m (24 ft 10¾ in)
Elevator span	7.31 m (23 ft 11¾ in)
Wheel track (c/l of shock-struts)	4.10 m (13 ft 5½ in)
Wheelbase	8.78 m (28 ft 9¾ in)
Propeller diameter	3.96 m (13 ft 0 in)
Distance between propeller centres	8.10 m (26 ft 7 in)
Propeller fuselage clearance	0.82 m (2 ft 8¼ in)
Propeller ground clearance	1.17 m (3 ft 10 in)
Passenger door (rear, port): Height	1.75 m (5 ft 9 in)
Width	0.75 m (2 ft 5½ in)
Height to sill (at OWE)	1.46 m (4 ft 9½ in)
Service door (rear, stbd): Height	1.22 m (4 ft 0 in)
Width	0.61 m (2 ft 0 in)
Height to sill	1.375 m (4 ft 6¼ in)
Standard cargo/baggage door (fwd, port): Height	1.575 m (5 ft 2 in)
Width	1.295 m (4 ft 3 in)
Height to sill (at OWE)	1.17 m (3 ft 9¾ in)
Large cargo door (fwd, port, optional): Height	1.80 m (5 ft 11 in)
Width	2.95 m (9 ft 8 in)
Height to sill (at OWE)	1.05 m (3 ft 5¼ in)
Emergency exits (fwd, each): Height	0.91 m (3 ft 0 in)
Width	0.51 m (1 ft 8 in)
Crew emergency hatch (flight deck roof): Length	0.51 m (1 ft 8 in)
Width	0.48 m (1 ft 7 in)

DIMENSIONS, INTERNAL:

Cabin:	
Length (excl flight deck, incl toilet and baggage compartments)	14.72 m (48 ft 3½ in)
Max width	2.57 m (8 ft 5¼ in)
Max width at floor	2.26 m (7 ft 5 in)
Aisle width	0.46 m (1 ft 6 in)
Max height	1.90 m (6 ft 3 in)
Floor area	31.0 m ² (334 sq ft)
Volume	58.0 m ³ (2,048 cu ft)
Baggage/cargo compartment volume:	
front (42-46 passengers)	6.0 m ³ (212 cu ft)
front (48 passengers)	4.8 m ³ (170 cu ft)

front (50 passengers)	3.6 m ³ (127 cu ft)
rear	4.8 m ³ (170 cu ft)
total front & rear (46 passengers)	10.8 m ³ (381 cu ft)
Containerised cargo volume: 4 pallets	30.0 m ³ (1,059 cu ft)
5 LD3	22.4 m ³ (791 cu ft)
Bulk cargo volume: with 4 pallets	11.9 m ³ (420 cu ft)
with 5 LD3	10.0 m ³ (353 cu ft)
Gross usable cargo volume	56.0 m ³ (1,978 cu ft)

AREAS:

Wings, gross	54.50 m ² (586.6 sq ft)
Ailerons (total)	3.12 m ² (33.58 sq ft)
Flaps (total)	11.00 m ² (118.40 sq ft)
Spoilers (total)	1.12 m ² (12.06 sq ft)
Fin, excl dorsal fin	12.48 m ² (134.33 sq ft)
Rudder, incl tab	4.00 m ² (43.05 sq ft)
Tailplane	11.73 m ² (126.26 sq ft)
Elevators (total, incl tabs)	3.92 m ² (42.19 sq ft)

WEIGHTS AND LOADINGS:

Operating weight empty	11,250 kg (24,802 lb)
Max fuel weight	4,500 kg (9,921 lb)
Max payload	5,450 kg (12,015 lb) ¹
Max ramp weight	18,770 kg (41,380 lb)
Max T-O weight	18,600 kg (41,005 lb)
Max landing weight	18,300 kg (40,345 lb)
Max zero-fuel weight	16,700 kg (36,817 lb) ¹
Max wing loading	341.3 kg/m ² (69.90 lb/sq ft)
Max power loading	5.20 kg/kW (8.54 lb/shp)

¹ Optional increase of 300 kg (661 lb)

PERFORMANCE:

Max cruising speed at FL170 at 97% MTOW	300 kt (556 km/h; 345 mph)
Time to climb to FL170	9.9 min
Service ceiling OEL, ISA +10°C, 97% MTOW	5,485 m (18,000 ft)
T-O distance: ISA, S/L	1,165 m (3,825 ft)
ISA +10°C at 915 m (3,000 ft) for 300 n mile (556 km; 345 mile) stage with 48 passengers	1,163 m (3,815 ft)
FAR landing field length:	
S/L at landing weight with 48 passengers	1,040 m (3,415 ft)
S/L at MLW	1,126 m (3,695 ft)
Runway ACN for flexible runway, category B	10
Range with max fuel	1,600 n miles (2,963 km; 1,841 miles)
Max range with 48 passengers	840 n miles (1,555 km; 966 miles)

OPERATIONAL NOISE LEVELS:

Flyover	76.6 EPNdB
Sideline	80.7 EPNdB
Approach	92.4 EPNdB

ATR 42 MP SURVEYOR

TYPE: Maritime surveillance twin-turboprop.

PROGRAMME: Variant of ATR 42 airliner developed by Alenia Aeronautica. Exhibited in model form at Dubai Air Show, November 1995. Initially designated **SAR 42** and **ATR 42MP**. First airframe modified by Officine Aeronautiche Capodichino plant; maiden flight (CMX62166) in Surveyor configuration, but without equipment installed, 1 February 1999, was also delivery to Alenia at Caselle for systems integration. Italian civil certification received 24 October 1999; first delivery 14 December 1999.

CURRENT VERSIONS: Other missions include vessel search, identification and surveillance; maritime and coastal surveillance; pollution detection; search and rescue; medical evacuation; and VIP/troop/cargo/corporate/humanitarian transport.

ATR 42 MP Surveyor: Basic model, as described.

CUSTOMERS: Two ordered by Guardia di Finanza (Italian customs service) 1996 and first aircraft (MM62165) delivered that November but in normal transport configuration for training; converted to operational version in 2000: is ATR 42-400 for first two aircraft; third aircraft based on 42-500. All these now delivered.

Italian Guardia Costiera (Coast Guard) ordered one plus another option for unarmed version; first delivery (MM62170 '10-01', formerly of Italian Air Force) 30 May 2001; second aircraft delivered 2003.

No further orders reported by end of October 2006.

Data as ATR 42-400, except particulars below.

POWER PLANT: Two 1,566 kW (2,100 shp) Pratt & Whitney Canada PW121A turboprops driving Ratier-Figeac/Hamilton Sundstrand 568F six-blade propellers. Option for additional 650 kg (1,433 lb) of auxiliary fuel.

ACCOMMODATION: Flight crew of two, plus three mission operators in modified cabin. Rest/debrief area towards rear of cabin; galley/lavatory facilities at rear. Observer's station with bubble window each side of fuselage aft of wing. Rear door (port side) modified for in-flight opening, with Type I emergency exit opposite; civil-style large freight door in forward port side. SAR package behind rest area.

AVIONICS: Comms: VHF/UHF transceiver, AM-FM, VHF/FM/HF com transceiver, transponder/IFF, interphone and optional secure datalink.

Radar: Raytheon SV 2022 360° search radar; weather radar from ATR 42 retained.

Flight: ADS, VOR, DME, ADF, optional Tacan, FMS, IRS, INS/GPS, radio altimeter, direction-finder.



ATR 42 MP Surveyor

1158864

Mission: Galileo Avionica Airborne Tactical Observation and Surveillance system (ATOS) comprises mission management system; communications subsystem; L-3 Wescam turret beneath starboard landing gear panner containing Galileo FLIR; daylight TV sensor; Spectrolab SX16E searchlight and Thiokol L.U.-2B/B flare launcher all mounted in pod on starboard side of forward fuselage; Elettronica ALR-733 ESM, MIL-STD-1553B, RS-422 and ARINC 429 databus system. Two multifunction operator consoles with 48 cm (19 in) display, 25 cm (10 in) sensor display, keyboard, trackball, joystick and colour printer on starboard side; communications console. Provision for future growth of sensor suite.

EQUIPMENT: SAR equipment includes searchlight, loudspeakers and flare launcher, IR/UV scanner and optional SLAR and MVR for pollution detection.

ARMAMENT: Optional FN Herstal HPM twin machine gun pod on port side of forward fuselage.

WEIGHTS AND LOADINGS:

Typical operating weight empty	13,275 kg (29,266 lb)
Max payload	3,425 kg (7,551 lb)
Optional auxiliary fuel	650 kg (1,433 lb)
Max T-O weight	18,600 kg (41,005 lb)
Max landing weight	18,300 kg (40,345 lb)
Zero-fuel weight: typical	13,200 kg (29,101 lb)
max	16,700 kg (36,817 lb)

PERFORMANCE (at max T-O weight except where indicated):	
Max cruising speed at FL160 at 97% MTOW	281 kt (520 km/h; 323 mph)
Typical patrol speed at FL20 at 90% MTOW:	
for max range	189 kt (350 km/h; 217 mph)
for max endurance	135 kt (250 km/h; 155 mph)
Service ceiling, OEL at 97% MTOW	3,960 m (13,000 ft)
T-O distance at S/L, ISA	1,050 m (3,445 ft)
Landing distance at MLW, S/L, ISA	1,150 m (3,775 ft)
Ferry range	2,019 n miles (3,740 km; 2,323 miles)
Endurance on station:	
at 200 n mile (370 km; 230 mile) radius	8 h
at 600 n mile (1,111 km; 690 mile) radius	3 h 30 min

ATR 72

TYPE: Twin-turboprop airliner.
PROGRAMME:

DEVELOPMENT MILESTONES

72	
Programme launched	15 Jan 86
First flight	27 Oct 88
Certification	25 Sep 89
First delivery (Kar Air)	27 Oct 89
72-500	
First flight	19 Jan 96
Certification	14 Jan 97
First delivery (American Eagle)	31 Jul 97

Stretched version of ATR 42; announced at 1985 Paris Air Show; launched 15 January 1986; three development aircraft built: first flights 27 October 1988 (F-WWEY), 20 December 1988 (F-WWEZ, c/n 108) and 18 April 1989 (OH-KRA, c/n 126); French and US certification 25 September and 15 November 1989 respectively; deliveries, to Kar Air of Finland, began 27 October 1989 (OH-KRB); UK certification 30 July 1993. Large cargo door certified 2002; launch customer Farnair of Switzerland.

CURRENT VERSIONS: **ATR 72-200:** Initial production version; two Pratt & Whitney Canada PW124B turboprops, each rated at 1,611 kW (2,160 shp) for normal take-off and 1,790 kW (2,400 shp) with ATPCS; Hamilton Sundstrand 14SF-11 four-blade propellers. Also cargo version, capable of carrying 13 small containers. Now discontinued.

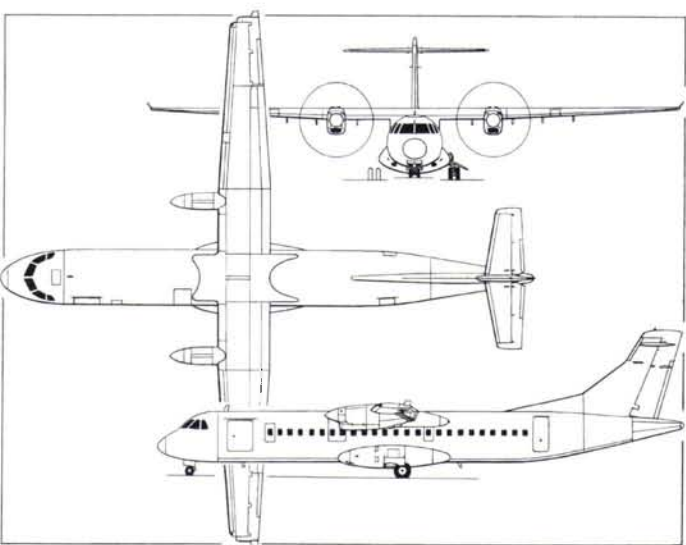
ATR 72-210: Improved hot/high performance version with PW127 engines rated at 1,849 kW (2,480 shp) and Hamilton Sundstrand 247F propellers with composites blades on steel hubs; ATPCS power 2,059 kW (2,760 shp); carries 17 to 19 more passengers than standard ATR 72 in WAT-limited conditions; French and US certification 15 and 18 December 1992. German on 24 February 1993; first delivery December 1992.

ATR 72-500: Launched as ATR 72-210A. Improved hot/high performance version with PW127 engines, six-blade propellers and redesigned interior. First flight 19 January 1996; DGAC certification achieved 14 January 1997; first delivery (to American Eagle) 31 July 1997.

Description applies to ATR 72-500, except where indicated.

ATR 72 Quick-Change: Similar to ATR 42 Quick-Change, except capacity for 13 ATR containers; conversion time approx 45 minutes.

ATR 72 full freighter version: Remarks as for equivalent ATR 42. Total cargo volume 75.5 m³ (2,666 cu ft); parallel cabin section 14.75 m (48 ft 4¾ in) long, with positions for up to six spider nets. MTOW in this configuration 22,000 kg (48,501 lb); MLW 21,350 kg (47,069 lb); MZFW 20,000 kg (44,092 lb). LCD as for ATR 42 freighter; permits loading of five 224 × 274 cm (88 × 108 in) pallets or seven LD3 containers. Max payload for



ATR 72-200 (two Pratt & Whitney Canada PW124B turboprops)
(Dennis Punnett)

1158760

first-generation aircraft fitted with "tube" and LCD is 8,093 kg (17,842 lb). First retrofit (to c/n 108) completed for Farnair by Aeronavi (subsidiary of Alenia Aeronautica) in June 2002; second for same customer, in 2004.

ATR 72 ASW: Projected anti-submarine warfare version, based on ATR 42 but also offering 1,270 kg (2,800 lb) payload including torpedoes, depth charges and anti-ship missiles. Turkish Navy opted in March 2005 for 10 ATR 72-500s equipped for both maritime patrol and ASW with Thales Amascos mission system and Oceanmaster surveillance radar; deliveries to begin in 2007.

CUSTOMERS: Total 433 ATR 72s ordered up to 30 September 2006, of which 314 delivered by 12 July 2006. Deliveries in 1998 totalled 21 and in 1999 numbered 23. Orders in 2000 totalled 18 plus six options; 15 (all -500s) delivered in 2001, 14 in 2002 and six in 2003; further 11 (Binter Canarias six, Air Tahiti four, Air New Zealand one) ordered by July 2004. Orders in 2005 totalled 73 from Air Deccan (30), Air Caraïbes (one), Air Caledonie (two), Air Madagascar (two), CCM Airlines (six), Turkish Navy (10 ASW), Air Tahiti (one), Binter Canarias (one) and Kingfisher Airlines (20).

COSTS: ATR 72-500, USD17.5 million (2004).

DESIGN FEATURES: As ATR 42 (which see), but with more power, more fuel, greater wing span/area, and longer fuselage for up to 74 passengers.

FLYING CONTROLS: As for ATR 42 but vortex generators ahead of ailerons and aileron horn balances shielded by wingtip extensions; vortex generators under leading-edge of elevators. Flap settings 0, 15 and 30°.

STRUCTURE: Generally as for ATR 42, but new wings outboard of engine nacelles have CFRP front and rear spars, self-stiffening CFRP skin panels and light alloy ribs, resulting in weight saving of 120 kg (265 lb); sweepback on outer panels 2° 18' at quarter-chord. Trials of an all-composites tail assembly were conducted in 1997 and the structure incorporated in all production aircraft from 1998. The major airframe inspection period for the ATR 72 was increased on 2 October 1997 from 24,000 to 36,000 cycles, with a corresponding reduction in maintenance cost, bringing it in line with the ATR 42 family.

LANDING GEAR: Messier-Hispano-Bugatti units with Dunlop wheels (tyres size H34x10.0R16 (14 ply), pressure 7.86 bar; 114 lb/sq in) and structural carbon brakes; nosewheel tyre as ATR 42. Minimum ground turning radius: at nosewheel 12.45 m (40 ft 10¼ in); at mainwheel 8.26 m (27 ft 1¼ in); at wingtip 19.74 m (64 ft 9¼ in).

POWER PLANT: ATR 72-500: Two Pratt & Whitney Canada PW127F turboprops, each rated at 1,864 kW (2,500 shp) for normal flight and 2,051 kW (2,750 shp) for take-off, driving Ratier-Figeac/Hamilton Sundstrand 568F six-blade, all-composites propellers. Fuel capacity 6,337 litres (1,674 US gallons; 1,394 Imp gallons), comprising ATR 42 tanks, plus additional 637 litres (168 US gallons; 140 Imp gallons) in outer wings; pressure refuelling point in starboard main landing gear fairing.

ACCOMMODATION: Basic 68 passengers at 79 cm (31 in) seat pitch; other seating configurations range from 64 seats at 81 cm (32 in) to 72 seats at 76 cm (30 in) or high-density 74 seats at 74 cm (29 in); plus second cabin attendant's seat. Corporate version also available; typical seating for 44 passengers plus lounge area. Single baggage compartment at rear of cabin; two at front. Forward door, with a service door opposite on starboard side. Service door on each side at rear, that on port side replaced by a passenger door when cargo door is fitted at front. Two additional emergency exits (one each side); both rear doors also serve as emergency exits. Increased-capacity air conditioning system.



ATR 72-500 of Kingfisher Airlines

1158869

AVIONICS (ATR 72-500): *Comms:* Rockwell Collins VHF transceiver and Mode S transponder; EADS Socata ELT; Loral CVR.
Radar: Honeywell weather radar.
Flight: Rockwell Collins VOR/ILS/MKR, ADF and DME; Honeywell EFIS (EADI and EHSI) and air data computer.
Instrumentation: Honeywell ASI, VSI and altimeter; Aeronetics RMI; Smiths standby compass; Thales standby horizon, altimeter and ASI.

DIMENSIONS, EXTERNAL: As ATR 42 except:

Wing span	27.05 m (88 ft 9 in)
Wing chord at tip	1.59 m (5 ft 2½ in)
Wing aspect ratio	12.0
Length overall	27.17 m (89 ft 1¾ in)
Height overall	7.65 m (25 ft 1¼ in)
Wheelbase	10.77 m (35 ft 4 in)
Propeller ground clearance: at OWE	1.21 m (3 ft 11½ in)
at max ramp weight	1.12 m (3 ft 8 in)
Passenger door (rear, port): Height	1.73 m (5 ft 8 in)
Width	0.635 m (2 ft 1 in)
Height to sill	1.375 m (4 ft 6¼ in)
Cargo door (fwd, port): Height	1.575 m (5 ft 2 in)
Width	1.295 m (4 ft 3 in)
Height to sill	1.12 m (3 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin:

Length (excl flight deck, incl toilet and baggage compartments)	19.21 m (63 ft 0¼ in)
Cross-section	as for ATR 42
Floor area	41.7 m² (449 sq ft)
Volume	76.0 m³ (2,684 cu ft)

Baggage/cargo compartment volume:

front (68 passengers)	5.8 m³ (205 cu ft)
rear	4.8 m³ (169.5 cu ft)
total	10.6 m³ (374.5 cu ft)

Containerised cargo volume: 5 pallets

7 LD3	42.6 m³ (1,504 cu ft)
Bulk cargo volume: with 5 pallets	31.4 m³ (1,109 cu ft)
with 7 LD3	13.3 m³ (470 cu ft)
Gross usable cargo volume	11.7 m³ (413 cu ft)
	75.5 m³ (2,666 cu ft)

AREAS: As ATR 42 except:

Wings, gross	61.0 m² (656.6 sq ft)
--------------	-----------------------

Ailerons (total)	3.75 m² (40.36 sq ft)
Flaps (total)	12.28 m² (132.18 sq ft)
Spoilers (total)	1.34 m² (14.42 sq ft)

WEIGHTS AND LOADINGS:

Operating weight empty	12,950 kg (28,550 lb)
Max fuel weight	5,000 kg (11,023 lb)
Max payload: standard	7,350 kg (16,204 lb)
optional	7,850 kg (17,306 lb)
Max T-O weight: standard	22,500 kg (49,604 lb)
optional	22,800 kg (50,265 lb)
Max ramp weight: standard	22,670 kg (49,979 lb)
optional	22,970 kg (50,640 lb)
Max landing weight: standard	22,350 kg (49,273 lb)
Max zero-fuel weight: standard	20,300 kg (44,754 lb)
optional	20,800 kg (45,856 lb)
Max wing loading: standard	368.9 kg/m² (75.55 lb/sq ft)
optional	373.8 kg/m² (76.55 lb/sq ft)
Max power loading: standard	5.49 kg/kW (9.02 lb/shp)
optional	5.56 kg/kW (9.14 lb/shp)

PERFORMANCE:

Max cruising speed at FL170, at 97% MTOW: both	276 kt (511 km/h; 318 mph)
Econ cruising speed at FL230, at 95% MTOW	248 kt (459 km/h; 285 mph)
Service ceiling	7,620 m (25,000 ft)
Service ceiling, OEL, ISA + 10 C, 97% MTOW	4,330 m (14,200 ft)
T-O balanced field length: at S/L, ISA: basic	1,290 m (4,235 ft)
optional	1,333 m (4,375 ft)
at FL30, ISA +10 C, at T-O weight, 68 passengers: both	1,300 m (4,265 ft)
Landing field length at S/L, at MLW: both	1,067 m (3,500 ft)
Runway ACN for flexible runway, category B	13
Still air range, reserves for 87 n mile (161 km; 100 mile) diversion and 45 min:	
max payload: basic	890 n miles (1,650 km; 1,025 miles)
optional	1,004 n miles (1,860 km; 1,155 miles)
max fuel and zero payload	1,956 n miles (3,622 km; 2,251 miles)

OPERATIONAL NOISE LEVELS:

Flyover	79.0 EPNdB
Sideline	83.2 EPNdB
Approach	92.2 EPNdB

BELL/AGUSTA

BELL/AGUSTA AEROSPACE COMPANY (BAAC)

11700 Plaza America Drive, Suite 1000, Reston, Virginia, 20190

Web: www.bellagusta.com

MANAGING DIRECTOR: Louis P Bartolatta Jr

EXECUTIVE MANAGING DIRECTORS:

Don Barbour (BA609 Programme)

Antonio Giovannini (AB139 Programme)

PARTICIPATING COMPANIES

Bell Helicopter Textron: see under USA

Agusta: see under Italy

Bell and Agusta announced on 8 September 1998 that they had agreed to establish a joint venture to manage development of two new aircraft: the BA609 tiltrotor, previously a Bell and Boeing programme, and the AB139, a new helicopter announced on the same day. Following approval of both boards, a definitive agreement was signed on 6 November 1998. Bell is the majority shareholder and intended to undertake final assembly for AB139s delivered to North America. Agusta, which has built Bell helicopters under licence since 1952, is investing and participating in development of the BA609, manufacturing some components and assembling those sold in Europe and certain other parts of the world. Additionally, AgustaWestland was responsible for the AB139's development and certification, with participation by Bell. A military version was revealed in July 2000. Flight testing of the AB139 began in February 2001, followed by the BA609 in March 2003. Bell/Agusta company headquarters relocated from Fort Worth, Texas, to Reston, Virginia, in March 2005.

In December 2005, AgustaWestland announced it would purchase Bell's 25 per cent of AB139 programme and make its own provision for a parallel US assembly line in Philadelphia. The helicopter was subsequently designated AW 139. BA609 remains a joint venture, although AgustaWestland to increase its share of development investment, thereby raising its stake in the programme from 25 to 40 per cent.

BELL/AGUSTA BA609

TYPE: Light utility tiltrotor.

PROGRAMME:

DEVELOPMENT MILESTONES

Announced	Feb 96
Design submitted	May 97
First prototype material cut	Aug 97
Mockup unveiled	Jun 97
Ground-running began	6 Dec 02
First flight	7 Mar 03
First transition to aircraft mode	22 Jul 05

Having earlier joined in partnership to develop the military V-22 tiltrotor, Bell Boeing revealed in February 1996 that studies were in progress for a nine-passenger civil tiltrotor aircraft in the 6,350 kg (14,000 lb) weight class, with the preliminary designation D-600.



Bell/Agusta BA609 prototype during 2005 flight testing (landing gear doors not fitted during first series of trials)

1133989

Subsequently, on 18 November 1996, the two companies announced that a joint venture was being established to design, develop, certify and market a six- to nine-passenger civil tiltrotor as the Bell Boeing 609.

Boeing withdrew as a partner on 1 March 1998 and Bell subsequently teamed with Agusta to develop, produce and market the tiltrotor as the BA609; this arrangement was formally announced at the Farnborough Air Show in September 1998. Agusta is investing and participating in BA609 development and will be responsible for assembly of BA609s sold in Europe and elsewhere.

Preliminary design review completed May 1997. Manufacture of parts for prototypes began at Philadelphia, August 1997. Full-size mockup first exhibited at Paris Air Show, June 1997.

Ground-running trials began on 6 December 2002. First flight of the prototype (N609TR) took place (in the vertical mode only) on 7 March 2003, rescheduled from late 2002, following decision in April 2002 to slow development and certification as consequence of delays in Bell Boeing V-22 Osprey programme, the latter being leader in technology development. Prototype flew some 14 hours in first two months, with rotors angled up to 15° forward before being disassembled for examination. Flight testing resumed on 3 June 2005 with a 1.3 hour flight, followed by the first full conversion to aircraft mode on 22 July 2005 when the BA609 reached a maximum speed of 190 kt (352 km/h; 219 mph). Second prototype (N609AG, c/n 60002), built by AgustaWestland at Cameri, Italy: began ground runs 13 July 2006; first flew 9 November 2006.

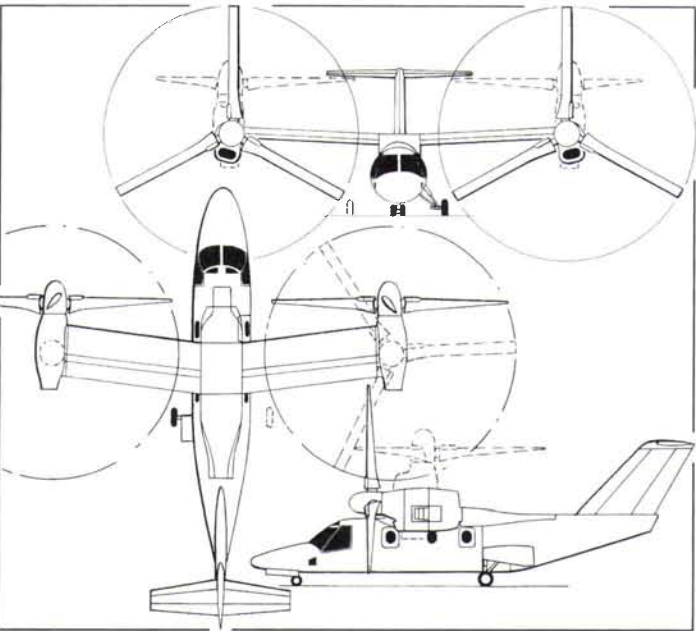
Four prototypes are being produced for 36-month flight test programme leading to certification in 2007 under FAR Pt 25 (fixed-wing aircraft) and Pt 29 (helicopters), plus Pt 21.17(b) Special Conditions for unique components. To be capable of single-pilot IFR operation. Prototype used primarily for expansion of flight envelope, while second, third and fourth airframes are dedicated to systems certification, avionics and icing approval, and FAA function and reliability, respectively. Second prototype, built at AgustaWestland plant in Italy; third airframe (also Italian) will be dedicated to icing and other certification tests, while fourth (US) aircraft will serve as avionics test and certification airframe. Certification in FAA Powered Lift category, including two-crew IFR and flight into known icing approvals, expected in 2010.

CURRENT VERSIONS: **BA609:** Initial version as described.



Second, Italian-built, Bell/Agusta BA609 on its maiden flight, 9 November 2006

1040379



Bell/Agusta BA609 tiltrotor aircraft (James Goulding)

1158944

HV-609: Multimission version proposed by Bell and Lockheed Martin to satisfy US Coast Guard 'Deepwater' re-equipment programme as potential replacement for Dassault HU-25 Guardian, Eurocopter HH-65 Dolphin and Sikorsky HH-60J Jayhawk. Missions could include drug interdiction and SAR, with 30 to 50 HV-609s possibly being acquired.

UV-609: Utility version conceived by Bell for US Army combat role, including casualty evacuation, command and control, logistic support and light utility/troop transport tasks. Manufacturer also promoting UV-609 to US Marine Corps as potential training system for V-22 Osprey.

619: Projected 19-seat version aimed at commuter market; not launched by March 2003.

620: Proposed 22-seat version conceived by Bell Boeing team; no recent news received and concept may have lapsed.

CUSTOMERS: Order book opened 2 February 1997 at Heli Expo, with first order placed soon after by unspecified customer. Total of 70 ordered by 40 customers in 18 countries by March 2003; purchasers identified to date include Helitech Pty of Australia; Lider of Brazil; Canadian Helicopter Corporation and Northern Mountain Helicopters Inc of Canada; Petroleum Tiltrotors International of Dubai; Aero-Dienst GmbH of Germany; Mitsui of Japan; United Industries of South Korea; Helikopter Services of Norway; Lloyd's Investments of Poland; Bristow of the UK; Massachusetts Mutual Life Insurance, Austin Jet and Petroleum Helicopters of the USA; and Air Center Helicopters Inc of the US Virgin Islands. Briefing given to US Coast Guard, late 1997, followed by demonstration by XV-15 tiltrotor concept demonstrator aboard Coast Guard cutter *Mohawk* off Key West, Florida, in May 1999.

COSTS: USD8 million to USD10 million, depending on configuration.

DESIGN FEATURES: Combines the most favourable aspects of helicopter and aeroplane performance in passenger-carrying role. T tail configuration instead of endplate fin layout used by earlier tiltrotor designs (XV-15 and V-22 Osprey); this raises horizontal tailplane above rotor wake to minimise fore and aft pitching moment at transition phase of flight. Size of wing determined by requirement for it to hold all fuel for CG and safety considerations. Composites cross-shafts keep both propellers turning in event of engine failure. Manual screwjack facility exists whereby the propellers can be tilted into helicopter mode if cross-shafts fail. Designed using three-dimensional CATIA digital computer design system. Airframe has design life of 20,000 flight hours.

Refer also to Bell Boeing V-22 description for explanation of tiltrotor concept and for its extension to four-propeller configuration.

FLYING CONTROLS: BAE Systems triplex digital fly-by-wire flight control system, with Dowty Aerospace actuators. T tail with conventional elevators; no rudder. Two-segment trailing-edge flaperons.

STRUCTURE: Aluminium fuselage structure with composites skinning; composites wing. Production fuselages, including cockpit, cabin and systems installation, will be built by risk sharing partner Fuji Heavy Industries of Japan, which may also establish a third production line if substantial orders are won from the Japanese government; cabin doors and fuselage tailcone supplied by Kawasaki; wing and nacelles by Bell at Fort Worth, with final assembly line at new Bell tiltrotor manufacturing facility in Amarillo, Texas and at Agusta facility in Italy. Fuselage in three major sections; nose, centre and tail, with fuselage skin incorporating graphite stringers with Japanese Toray composites material. Same used for wing and nacelles, with upper and lower wing surfaces produced as single pieces.

LANDING GEAR: Retractable tricycle type, with twin nosewheels and single wheel on each main unit. Messier-Dowty overseeing design, development and manufacture of integrated landing gear system, including legs, wheels, tyres, brakes, brake control and landing gear control systems.

POWER PLANT: Two 1,447 kW (1,940 shp) Pratt & Whitney Canada PT6C-67A turboshaft engines, installed in tilting nacelles at wingtips, each driving a three-blade propeller. Nacelle interface units by AMETEK Aerospace Systems. Rockwell Collins EICAS; modified oil system, with dual pumps, to generate sufficient oil pressure when operating in vertical mode; several planetary gears also removed to achieve direct drive 30,000 rpm output. Nacelle transition achieved in 20 seconds. Fuel in integral wing tanks; usable capacity 1,401 litres (370 US gallons; 308 Imp gallons). Provision for auxiliary fuel tanks.

ACCOMMODATION: Crew of two, side by side on flight deck, with dual controls. Maximum of nine passengers in standard aircraft in 2+2+3 configuration. Optional layouts provide for six passengers in executive layout, eight passengers in double club configuration, or two stretchers and three attendants in EMS configuration. Crew and passenger door on starboard side, forward of wing. Accommodation pressurised and air conditioned; pressurisation differential 0.38 bar (5.50 lb/sq in). Transparency by Sully Produits Speciaux of France.

SYSTEMS: Equipped for flight into known icing. Lucas Aerospace DC electrical power systems. Intertechnique brushless electric pumps and motor-operated shut-off valves.

AVIONICS: Rockwell Collins Pro Line 21 package as standard.

Comms: Dual VHF radios; Mode S transponder. Cockpit voice recorder included as standard.

Radar: Optional Rockwell Collins WXR-800 solid-state weather radar.

Flight: Dual VOR/ILS, DME and ADF, with integrated control of sensors by dual Rockwell Collins RTU-4200 radio tuning units, Rockwell Collins ALT-4000 radar altimeter optional, GPS included as standard, along with TCAS and FDR.

Instrumentation: Three 250 x 200 mm (10 x 8 in) active matrix colour LCD adaptive flight displays, including two primary flight displays and one multifunction display. Standby instrument system by Goodrich Aerospace.

Following data are provisional.

DIMENSIONS, EXTERNAL:

Propeller diameter (each)	7.9 m (26 ft)
Width, rotors turning	18.3 m (60 ft)
Length overall	13.4 m (44 ft)
Max diameter of fuselage	1.75 m (5 ft 9 in)
Height to top of fin	4.6 m (15 ft)
Wheel track	3.0 m (10 ft)
Wheelbase	5.8 m (19 ft)
Distance between propeller centres	10.0 m (33 ft)
Passenger door: Width	0.76 m (2 ft 6 in)

DIMENSIONS, INTERNAL:

Cabin: Length	4.09 m (13 ft 5 in)
Max width	1.47 m (4 ft 10 in)
Max height	1.42 m (4 ft 8 in)
Baggage hold volume	1.4 m ³ (50 cu ft)

AREAS:

Rotor discs, each	49 m ² (530 sq ft)
-------------------	-------------------------------

WEIGHTS AND LOADINGS:

Weight empty	4,765 kg (10,500 lb)
Max T-O weight	7,620 kg (16,800 lb)
Max disc loading	77.4 kg/m ² (15.85 lb/sq ft)

PERFORMANCE:

Max cruising speed	275 kt (509 km/h; 316 mph)
Max rate of climb at S/L	457 m (1,500 ft)/min
Service ceiling	7,620 m (25,000 ft)
Service ceiling, OEI	3,901 m (12,800 ft)
Hovering ceiling, OEI	1,525 m (5,000 ft)
Range: normal fuel capacity with 2,500 kg (5,500 lb) payload at 250 kt (463 km/h; 288 mph)	750 n miles (1,389 km; 863 miles)
with auxiliary fuel tanks	1,000 n miles (1,852 km; 1,151 miles)
Endurance, normal fuel	3 h

BOEING/BAE SYSTEMS

BOEING/BAE SYSTEMS

PARTICIPATING COMPANIES

Boeing (Integrated Defense Systems): see under USA
BAE Systems: see under UK

Original McDonnell Douglas Corporation (MDC) and Hawker Siddeley companies initially associated in 1969 through US procurement of Harrier; relationship further developed with US Navy selection of BAE Systems Hawk; both types built at St Louis, although production of the Harrier II ended in 1997. Joint work undertaken on advanced combat aircraft (later known as JSF), with additional participation of Northrop Grumman, until next-stage contracts were awarded to competing designs in November 1996. Boeing took over MDC in August 1997. Production of T-45 Goshawk continues, albeit at less than minimum economic rate, but procurement to end with batch of 12 aircraft in FY07.

BOEING/BAE SYSTEMS T-45 GOSHAWK

TYPE: Advanced jet trainer.
PROGRAMME:

DEVELOPMENT MILESTONES

Official go-ahead	18 Nov 1981
First order	26 Jan 1988
First prototype material cut	Feb 1986
First flight	16 Apr 1988
First delivery	23 Jan 1992
Entered service	27 Jun 1992

Carrier-capable version of BAE Systems Hawk selected 18 November 1981 (from five other candidates) as winner of US Navy VTXTS (now T45TS) competition for undergraduate jet pilot trainer to replace T-2C Buckeye and TA-4J Skyhawk; original plan was for initial 54 'dry' (land-based) T-45Bs followed by 253 carrier-capable 'wet' T-45As; B model eliminated in FY84 in favour of 300 (and then 302) T-45As; FSD phase began October 1984; construction of two prototypes by Douglas began February 1986; funding approved 16 May 1986 for first three production lots. Lot 1 production contract (12 aircraft) awarded 26 January 1988; FSD prototypes made first flights 16 April (162787) and November 1988 (162788); original planned date for first deliveries (October 1989) delayed by further airframe and power plant changes requested by US Navy.

Announced 19 December 1989 that entire T45TS programme to be transferred to McDonnell Aircraft Co at St Louis; modified FSD prototypes made first flights September and October 1990; two Douglas production aircraft (163599 and '600) delivered to NATC Patuxent River, Maryland, on 10 October and 15 November 1990; first carrier landing (162787 on USS John F Kennedy) 4 December 1991; first McAir production aircraft (163601) flew at St Louis 16 December 1991 and handed over to USN 23 January 1992. Production one per month in 1995 following successful passing of US DoD Milestone III review on 17 January 1995 authorising full-rate production.

Digital/glass cockpit developed as 'Cockpit 21'; first to this standard (37th aircraft, 163635) made first flight 19 March 1994; planned production line introduction at 73rd aircraft, to be delivered October 1996, was delayed; flight trials of prototype aboard USS John C Stennis conducted April to May 1996 and successfully completed with 30 May approval for 'Cockpit 21' installation from 84th aircraft (165080), which first flew on 21 October 1997 and formally rolled-out on 31 October. Earlier aircraft being retrofitted with 'Cockpit 21' from FY03, following a validation conversion of T-45A 163651 in 1998.

Beginning in 2000, all T-45s fitted with modified engine air intakes during routine servicing at NAS Kingsville; new intake has the top 'lip' extended forward, giving a raked profile, improving engine airflow at high angles of attack and reducing number of surges and compressor stalls.

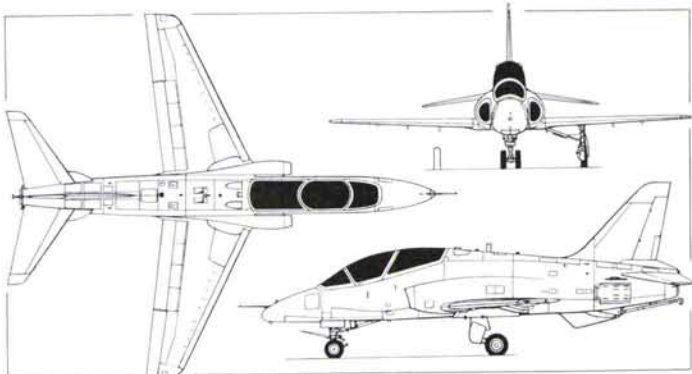
CURRENT VERSIONS: **T-45A:** Baseline version, with analogue instruments. Total of 83 produced, of which surviving 73 programmed for upgrade to T-45C standard.

T-45C: Digital ('Cockpit 21') avionics version with new computer, digital databus, data transfer cartridge and Litton GINA (GPS/INS assembly); first aircraft 165080; otherwise as T-45A; sole external difference is GPS antenna on spine of T-45C, immediately behind canopy.

CUSTOMERS: US Navy: two FSD prototypes and 223 production aircraft currently envisaged, with deliveries to terminate at the end of 2009. Final delivery of FY00 was 127th production aircraft; 139th delivered to US Navy in October 2001; 150th on 8 August 2002, with more than 180 delivered by end of October 2005. Complete T45TS programme also involves 19 flight simulators (built by Hughes Training Inc); 48 computer-aided instructional devices, one training integration system mainframe, six electronic classrooms, 155 terminals, plus academic materials and contractor-operated logistic support. USN T45TS requirement stipulated 42 per cent size reduction in (TA-4 and T-2) training fleet, 25 per cent fewer flight hours, and 46 per cent fewer personnel.

Four training squadrons (VT) to equip: VT-21 and VT-22 of Training Wing 2 at Kingsville, Texas, in 1992-96; VT-9 and VT-23 (which redesignated VT-7 on 1 October 1999) of TW-1 at Meridian, Mississippi, 1997-2003. TW-2 assigned early aircraft; TW-1 received about 90 'Cockpit 21' Goshawks (first official handover to VT-23 15 December 1997, aircraft having been received on 10 December). TW-2 accepted first new-build T-45C (165641) in late 2004 and will eventually also be fully equipped with this version, largely as a result of retrofit programme involving surviving T-45A aircraft. Small number of T-45s wear 'Marines' titles to reflect the proportion (about 13 per cent) of USMC student pilots being trained on the type.

VT-21 operational 27 June 1992 for instructor training; four-aircraft operational evaluation begun by VT-21 on 18 October 1993 for one month first phase; student training begun 4 January 1994; first student flight 11 February 1994; first solo 23 March 1994; deployed to Miramar for deck landing course on aircraft carrier, September 1994; course graduated 5 October 1994. Second phase of operational evaluation (advanced



Boeing/BAE Systems T-45C Goshawk tandem-seat basic and advanced trainer with revised intake shape (Dennis Punnett)

0099603

tactics/weapons and carrier qualification) on USS Dwight D Eisenhower ended with clearance for fleet introduction being recommended on 5 July 1994. VT-23 (now VT-7) of TW-1 began student training on 8 July 1998; VT-9 began re-equipping in 2003. T-45 syllabus is 119 sorties (156 hours) plus 100 simulator sessions (95.4 hours).

In April 2000, 1,000th student graduated from T45TS course; fleet passed 200,000 hours in March 1999. By May 2001, T-45s had flown 342,000 hours, made 22,000 deck landings and trained 1,328 pilots; first aircraft exceeded 5,000 hours in April 2001. Fleet passed 450,000 hours and 28,500 carrier landings in February 2003, at which time total of 1,800 students had graduated.

US NAVY PROCUREMENT

FY	Lot	Qty	First aircraft
88	1	12	163599
89	2	24	163611
92	3	12	163635
93	4	12	163647
94	5	12	165057
95	6	12	165069 ¹
96	7	12	165081
97	8	12	165457
98	9	15	165469
99	10	15	165484
00	11	15	165598
01	12	14	165613
02	13	6	165627
03	14	8	165633
04	15	14	165641
05	16	10	
06	17	6	
07	18	12	
Total		223	

¹ 'Cockpit 21' installed from 12th of this batch (165080).

COSTS: Original USD316 million for 12 aircraft in FY96 procurement augmented by USD6,830,421 for addition of 'Cockpit 21' modifications. Official unit cost USD17.2 million (1999); FY02 purchase of six aircraft valued at USD180.6 million, with USD218.2 million appropriation in FY03 for eight aircraft and USD339.2 million in FY04 for 14 aircraft.

DESIGN FEATURES: Carrier-capable adaptation of existing trainer design for cost and risk reduction. Generally as for two-seat BAE Systems Hawk Srs 60, but redesigned (including deeper and longer forward fuselage) and strengthened to accommodate new landing gear and withstand carrier operation (incidentally increasing fatigue life to 14,400 flying hours, although 28,800 hours achieved on static testing airframe); twin airbrakes of composites material; fin height increased by 15.2 cm (6 in) and single ventral fin added; rudder modified; tailplane span increased by 10.2 cm (4 in); wingtips squared off; nose tow launch bar added; underfuselage arrester hook, deployable 20° to each side of longitudinal axis. No provision for gun or outboard underwing hardpoints.

FLYING CONTROLS: Differences from two-seat BAE Systems Hawk include electrically actuated/hydraulically operated full-span wing leading-edge slats (operation limited to landing configuration); aileron/rudder interconnect; two fuselage-side airbrakes instead of one under fuselage and associated autotrim system for horizontal stabiliser when brakes deployed; BAE Systems yaw damper computer and addition of 'smurf' (side-mounted unit root fin), a small curved surface forward of each tailplane leading-edge root, to eliminate pitch-down during low-speed manoeuvres; Dowty actuators for slats and airbrakes.

STRUCTURE: BAE Systems (principal subcontractor) builds wings, centre and rear fuselage, fin, tailplane, windscreen, canopy and flying controls. Intended fatigue life of 14,000 hours. Batch of 54 composites tailplanes being built by Boeing for retrofit to extant T-45s.

LANDING GEAR: Wide-track hydraulically retractable tricycle type, stressed for vertical velocities of 7.28 m (23.9 ft)/s. Single wheel and long-stroke oleo (increased from 33 cm; 13 in of standard Hawk to 63.5 cm; 25 in) on each main unit; twin-wheel steerable nose unit with 40.6 cm (16 in) stroke. Articulated main gear, by AP Precision Hydraulics, is of levered suspension (trailing arm) type with a folding side-stay. Cleveland Pneumatic nose gear, with Sterer digital dual-gain steering system (high gain for carrier deck operations). Nose gear has catapult launch bar and holdback devices. Main units retract inward into wing, forward of front spar; nose unit retracts forward. All wheel doors sequenced to close after gear lowering; inboard mainwheel doors bulged to accommodate larger trailing arm and tyres. Gear emergency lowering by free-fall. Goodrich wheels, tyres and brakes. Mainwheel tyres size 24x7.7-10 (20 ply) tubeless; nosewheels have size 19x5.25-10 (12 ply) tubeless tyres. Tyre pressure (all units) 22.40 bar (325 lb/sq in) for carrier operation; reduced for land operation. Hydraulic multidisc mainwheel brakes with Dunlop adaptive anti-skid system.

POWER PLANT: One 26.00 kN (5,845 lb st) nominal rating Rolls-Royce Turbomeca F405-RR-401 (navalised Adour Mk 871) non-afterburning turbofan; installed rating 24.59 kN (5,527 lb st). Air intakes and engine starting as described for BAE Systems Hawk. Fuel system similar to BAE Systems Hawk, but with revision for carrier operation. Total internal capacity of 1,635 litres (432 US gallons; 360 Imp gallons). Provision for carrying one 591 litre (156 US gallon; 130 Imp gallon) drop tank on each underwing pylon.

ACCOMMODATION: Similar to BAE Systems Hawk, except that ejection seats are of Martin-Baker Mk 14 NACES (Navy aircrew common ejection seat) zero/zero rocket-assisted type.



Boeing/BAE Systems T-45C Goshawk of training squadron VT-9 (Paul Jackson)

1047211

SYSTEMS: Air conditioning and pressurisation systems, using engine bleed air. Duplicated hydraulic systems, each 207 bar (3,000 lb/sq in), for actuation of control jacks, slats, flaps, airbrakes, landing gear, arrester hook and anti-skid wheel brakes. No. 1 system has flow rate of 36.4 litres (9.6 US gallons; 8.0 Imp gallons)/min. No. 2 system a rate of 22.7 litres (6.0 US gallons; 5.0 Imp gallons)/min. Reservoirs nitrogen pressurised at 2.75 to 5.50 bar (40 to 80 lb/sq in). Hydraulic accumulator for emergency operation of wheel brakes. Pop-up Dowty Aerospace ram air turbine in upper rear fuselage provides emergency hydraulic power for flying controls in event of engine or No. 2 pump failure. No pneumatic system. DC electrical power from single brushless generator, with two static inverters to provide AC power and two batteries for standby power. Onboard oxygen generating system (OBOGS).

AVIONICS: Avionics and cockpit displays optimised for carrier-compatible operations.

Comms: Rockwell Collins AN/ARN-182 UHF/VHF. Honeywell APX-100 IFF.

Flight: AN/ARN-144 VOR/ILS by Rockwell Collins. Honeywell AN/APN-194 radio altimeter. Sierra AN/ARN-136A Tacan. BAE Systems yaw damper computer. T-45C version with digital avionics (aircraft No. 84 onwards) has revised navigation package comprising mission data input device (MDID); Litton LN-100G ring laser gyro and Rockwell Collins five-channel GPS linked by 12-state Kalman filter.

Instrumentation: US Navy AN/USN-2 standard attitude and heading reference system (SAHRS). Smiths Industries Mini-HUD (front cockpit). Racal Acoustics avionics management system, and Teledyne caution/warning system. Digital avionics from 84th production aircraft onwards; two 127 x 127 mm (5 x 5 in) Elbit monochrome multifunction screens in both cockpits. MIL-STD-1553B databus and Smiths HUD.

Mission: Electrodynamics airborne data recorder.

ARMAMENT: No built-in armament, but weapons delivery capability is incorporated. Single pylon under each wing for carriage of practice multiple bomb rack, rocket pods or auxiliary fuel tank. Provision for carrying single stores pod on fuselage centreline. CAI Industries weapon-aiming sight in rear cockpit.

DIMENSIONS, EXTERNAL:

Wing span	9.39 m (30 ft 9¾ in)
Wing chord: at root	2.87 m (9 ft 5 in)
at tip	0.89 m (2 ft 11 in)
Wing aspect ratio	5.0
Length, overall, incl nose probe	11.98 m (39 ft 4 in)
Height overall	4.11 m (13 ft 6 in)

Tailplane span	4.59 m (15 ft 0¾ in)
Wheel track (c/l of shock-struts)	3.90 m (12 ft 9½ in)
Wheelbase	4.31 m (14 ft 1¾ in)

AREAS:

Wings, gross	17.66 m² (190.1 sq ft)
Ailerons (total)	1.05 m² (11.30 sq ft)
Trailing-edge flaps (total)	2.50 m² (26.91 sq ft)
Airbrakes (total)	0.88 m² (9.47 sq ft)
Fin	2.61 m² (28.10 sq ft)
Rudder, incl tab	0.58 m² (6.24 sq ft)
Tailplane	4.43 m² (47.64 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	4,261 kg (9,394 lb)
Internal fuel: early production	1,312 kg (2,893 lb)
enhanced capacity	1,433 kg (3,159 lb)
Normal T-O weight	5,783 kg (12,750 lb)
Max T-O weight	6,123 kg (13,500 lb)
Max wing loading	346.7 kg/m² (71.02 lb/sq ft)
Max installed power loading	249 kg/kN (2.44 lb/lb st)

PERFORMANCE:

Design limit diving speed at 1,000 m (3,280 ft)	575 kt (1,065 km/h; 662 mph)
Max true Mach No. in dive	1.04
Max level speed at 2,440 m (8,000 ft)	543 kt (1,006 km/h; 625 mph)
Max level Mach No. at 9,150 m (30,000 ft)	0.84
Carrier launch speed	121 kt (224 km/h; 139 mph)
Approach speed (typical)	125 kt (232 km/h; 144 mph)
Max rate of climb at S/L	2,440 m (8,000 ft)/min
Time to 9,150 m (30,000 ft), clean	7 min 40 s
Service ceiling	12,950 m (42,500 ft)
T-O to 15 m (50 ft)	1,100 m (3,610 ft)
Landing from 15 m (50 ft)	1,009 m (3,310 ft)
Ferry range	700 n miles (1,296 km; 805 miles)
g limits	+7.33/-3

BWB
BLENDED WING-BODY AIRLINERS

During the 1990s, several companies and organisations investigated the possibilities of the flying wing as a next-generation, efficient, high-capacity airliner. Their initiatives were tracked in *Jane's All the World's Aircraft* under the heading UHCA/VLCT in the International section until 2002, when known activity was reduced to the Boeing BWB. Increased interest has resulted in four programmes being concentrated below.

BLENDED WING-BODY

TYPE: New-concept airliner.

PROGRAMME: In mid-1990s, shortly before absorption by Boeing, McDonnell Douglas released details of the BWB-I-1 (blended wing-body) study, giving the most comprehensive analysis yet of the flying wing's advantages for very large transport aircraft. This work continued after merger with Boeing, with at least half-a-dozen BWB derivatives under consideration at the beginning of 2002, ranging in passenger capacity from 180 to 570. An earlier BWB incarnation, able to carry 800 passengers over a 7,000 n mile (12,964 km; 8,055 mile) range, gave predicted benefits that included a 12.5 per cent reduction in T-O weight and 12.3 per cent less empty weight; 27.5 per cent reduction in fuel burn; 27.0 per cent reduction in installed thrust; and 20.6 per cent better lift/drag. These gains achieved by increasing wing area by 27.9 per cent (reducing loading by 33.6 per cent) and having a 19.2 per cent greater span.

Tests of a radio-controlled 5.5 m (18 ft) span scale BWB-I-1 were undertaken by Stanford University at El Mirage dry lake, California, in July 1997 as part of a USD2.3 million programme to evaluate flight control laws for a flying wing. Data generated by these trials were of poor quality, but a series of tethered wind tunnel tests of a 3.7 m (12 ft 2 in) span free flight model conducted by NASA in 2005 yielded useful results.

In co-operation with NASA, Boeing initiated development of a 14 per cent scale vehicle known as the BWB-LSV (blended wing body-low speed vehicle) in the late 1990s. Powered by three Williams J24-8 turbojet engines, this featured a 10.67 m (35 ft) wing span and weighed approximately 1,361 kg (3,000 lb). Construction began in 2000, at which time it was still known as the BWB-LSV, but it was subsequently assigned the experimental **X-48A** designation shortly before the end of 2001. Production and assembly of the X-48A was expected to have been completed by the end of 2002, with a lengthy series of ground testing planned for most of 2003, leading up to flight trials in 2004. In the event, the X-48A was quietly cancelled, among the reasons cited being difficulties encountered with the flight control system and budgetary considerations on the part of NASA.

Despite this setback, Boeing still wished to demonstrate BWB flight control systems and next approached Cranfield Aerospace of the UK in 2003 with a request to construct two examples of a smaller 8.5 per cent scale remotely piloted test vehicle. Given the designation **X-48B** on 15 June 2005, this is to undergo a joint trials programme in the USA for Boeing, NASA and the US Air Force Research Laboratory.

The X-48B is approximately 7.0 m (23 ft) long, with a span of 6.2 m (20 ft 4 in) and a wing area of 9.29 m² (100 sq ft). Weight has been reported as 237 kg (523 lb), with estimated performance figures including a max speed of 118 kt (218 km/h; 135 mph), a max altitude of 3,050 m (10,000 ft) and about 40 minutes' endurance. Power is provided by three 0.22 kN (50 lb st) model aircraft microjet engines and the X-48B features a total of 20 control surfaces on the wing trailing-edge, of which the outer ailerons are split surfaces,



Boeing X-48B prepared for 2007 flight trials (NASA) 1040466

with the ability to function as drag rudders and speed brakes. In event of an emergency landing being necessary, a recovery parachute and airbag are installed, as is a spin recovery parachute for use in departure from controlled flight during a planned series of high AoA stall tests.

Cranfield Aerospace was also responsible for the supply of a control vehicle, but software for flight control was developed by Boeing's Phantom Works. Flight testing is to take place at NASA's Dryden Research Center at Edwards AFB, California and will be undertaken by the second X-48B; ground checkout of this was under way at Dryden in late 2006, with a series of five flights scheduled for early 2007. Previously, some 250 hours of wind tunnel testing was completed by the first X-48B at NASA's Langley, Virginia, facility between 7 April and mid-May 2006, with this craft then being transferred to Dryden to serve as a back-up vehicle for the flight test programme. Investigation of stall characteristics, spin and tumble, asymmetric thrust and ground effects are among the test objectives, in addition to studies of dynamic interaction between control surfaces, wing aerodynamics and inlet conditions.

One potential application considered by Boeing is a BWB tanker for multipoint aerial refuelling. Equipped with three 'smart' booms, two hose/drogue refuelling points and automated refuelling capabilities, BWB tanker would be able to accommodate simultaneous air-to-air refuelling of multiple conventional aircraft or UAVs. Fuel carried in wing tanks; maximum payload space would be available for up to 23 conventional pallets and 40 troops.

As a C2ISR (command, control, intelligence, surveillance, reconnaissance) platform, the BWB would provide increased loiter time, large interior space suitable for battle management control rooms, and ample exterior locations for conformal phased-array antennas for broadband communications with no increase in radar signature. These capabilities make the BWB additionally suitable as a long-range standoff weapons platform.

Other possible military derivatives could include a version to satisfy a future USAF cargo aircraft requirement.

Another organisation known to be conducting investigations into the Blended Wing Body configuration is the **Hamburg University** of Applied Sciences in Germany. This has conceived a design meant to represent a notional 900-seat airliner known as the AC 20.30 that could enter service in 2030. Project has involved construction of a radio-controlled 1:30 scale model, which flew for the first time at Itzehoe on 16 December 2003 and which undertook extensive wind tunnel testing at Dresden in September 2005 to provide data for additional flight trials.

Also in Germany, as part of EC's five-year EUR160 million Lufo III air transport technology development project, **BWB-Demonstratormodell** developed by Department of Conceptual Aircraft Design at **Stuttgart University** and Institut für Flugzeugbau, with assistance from Institut für Flugmechanik und Flugregelung and Steinbeis Transferzentrum Aerodynamik, Flugzeug- und Leichtbau. Single-jet model aircraft shown at ILA, Berlin, May 2006.

BWB configuration is also being investigated as a means of reducing the sound impact of aircraft in a study led by Cambridge University in the UK and Massachusetts Institute of Technology. Silent Aircraft Initiative **SAX-40** is funded by the **Cambridge-MIT Institute** (CMI); launched in 2003 with a grant from CMI of GBP2.3 million; first public



Stuttgart University/IF BWB-Demonstratormodell (Paul Jackson) 1040493



Hamburg University AC 20.30 flying scale model (Paul Jackson) 1040488

announcement 6 November 2006; includes teams involved in different aspects of aircraft design for a multidisciplinary approach: core personnel are 40 CMI researchers. Project has received significant collaborations from all parts of the civil aerospace/aviation industry including British Airways, BAA, Boeing, Br  l & K  r, Civil Aviation Authority, Cranfield University, DHL, easyJet, Eurocontrol, HACAN Clearskies, Lochard, London Luton Airport, Marshall of Cambridge Aerospace, National Air Traffic Services (NATS), Nottingham East Midlands Airport, Royal Aeronautical Society and Rolls-Royce.

Noise reduction measures concentrate on take-off, climbout and approach phases of flight. On departure, this is achieved by engines embedded within the fuselage with intakes above the wings to shield much of the engine noise from listeners on the ground; novel, ultra-high bypass engines with a variable-area exit nozzle which can operate for low noise with low-speed exhaust jets at take-off and during climb, and then be optimised for minimum fuel burn in cruise; thrust, nozzle settings and climb rate optimised for low noise, subject to meeting legal requirements; long engine exhaust ducts to provide space for extensive acoustic liners.

On approach, the airframe on a conventional aircraft is as noisy as the engines. SAX-40 approach noise is reduced by an airframe design that enables the aircraft to approach at lower speed and so land further down the runway; low-noise fairings on the landing gear; advanced aerofoil trailing-edge treatment; a deployable drooped leading-edge on the wings and vectored thrust, which are used to enable low-speed flight without noise penalty; absence of flaps and slats; engines having a low idle thrust and able to respond rapidly if a go-around is necessary.

SAX-40 is a 215-seat (three-class) 'all-lifting' design, producing lift on centrebody as well as wings; makes use of a novel centrebody shape with leading edge carving; this balances aerodynamic forces without the need for tail surfaces, and enables an optimal wing



SAX-40 low-noise, high efficiency aircraft by Cambridge University and MIT 1040472

DIRGANTARA/AERONIMBUS

DIRGANTARA/AERONIMBUS

Dirgantara: see Indonesia
AeroNimbus: see Malaysia

Companies collaborating from 2005 on NMX-1 new small passenger jet for Asia/Middle East market.

DIRGANTARA/AERONIMBUS NMX-1

TYPE: Light business jet.
PROGRAMME: Launched 7 January 2005 with plans for Dirgantara to design and build prototype and produce detail parts at Bandung; final assembly and certification by AeroNimbus in Malaysia. First flight then targeted for late 2006; however, according to reports at Asian Aerospace show in Singapore in February 2006, one of AeroNimbus'

EADS

EUROPEAN AERONAUTIC, DEFENCE AND SPACE COMPANY NV

Le Carr  , Beechavenue 130-132, NL-1119 PR Schiphol-Rijk, Netherlands
Tel: (+31 20) 655 48 00
Fax: (+31 20) 655 48 01
Web: www.eads.net

PARTICIPATING COMPANIES

Aerospatiale Matra: EADS, France
CASA: EADS CASA, Spain
DaimlerChrysler Aerospace (DASA): EADS Deutschland, Germany

CHAIRMEN:

Arnaud Lagard  re
Manfred Bischoff

CHIEF EXECUTIVES:

Philippe Camus
Rainer Hertrich

CORPORATE COMMUNICATIONS:

D-81663 M  nchen
Tel: (+49 89) 60 70

design with an elliptical lift distribution and low cruise drag. Performance includes 149 passenger-miles per Imperial gallon of fuel (compared with about 120 for the best current aircraft in this range and size). This is equivalent to the Toyota Prius Hybrid car carrying two passengers. Noise of 63 dBA outside airport perimeter—some 25dB quieter than current aircraft.

Notional engines are 'Granta-3401'. Single core driving three high-capacity, low-speed fans. Distributed propulsion system is designed to ingest centrebody boundary layer, which reduces the fuel burn. Multiple small fan design is easier to embed in the airframe and leads to reduced weight and nacelle drag; also enhances boundary layer ingestion, thereby improving fuel efficiency, and the low fan tip speeds produce low noise. Ultra-high bypass ratio 18.3 at take-off for low jet noise, 12.3 at top of climb for good efficiency.

Several possible Boeing BWB derivatives have emerged as candidates for production, including the **BWB-250**, with accommodation for about 260 passengers, and the **BWB-450** with room for about 480 passengers.

Estimated data below refer to the 800-seat Boeing BWB-1-1 proposal powered by three 275 kN (61,900 lb st) turbofans and CMI SAX-40 with three 'Granta-3401' engines.

DIMENSIONS, EXTERNAL:

Wing span: excl winglets, BWB-1	85 m (280 ft)
incl winglets: BWB-1	88 m (289 ft)
SAX-40	67.54 m (221 ft 7 in)
Wing aspect ratio: BWB-1	5.1
SAX-40	5.5
Length overall, BWB-1	49 m (161 ft)
Height overall, BWB-1	15 m (50 ft)

AREAS:

Wings: trap, BWB-1	728 m ² (7,840 sq ft)
gross: BWB-1	1,423 m ² (15,325 sq ft)
SAX-40	835.9 m ² (8,998 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, BWB-1	167,750 kg (369,800 lb)
Weight empty, equipped: BWB-1	186,900 kg (412,000 lb)
SAX-40	94,190 kg (207,660 lb)
Max payload: BWB-1	104,800 kg (231,000 lb)
SAX-40	23,405 kg (51,600 lb)
Max fuel weight: BWB-1	122,500 kg (270,000 lb)
SAX-40	33,252 kg (73,310 lb)
Max T-O weight: BWB-1	373,300 kg (823,000 lb)
SAX-40	150,840 kg (332,550 lb)
Max zero-fuel weight, BWB-1	291,650 kg (643,000 lb)
Fuel burn over 7,000 n miles with 800 passengers, BWB-1	96,820 kg (213,450 lb)
Max wing loading: BWB-1	513 kg/m ² (105 lb/sq ft)
SAX-40	180.4 kg/m ² (36.96 lb/sq ft)
Max power loading, BWB-1	452 kg/kN (4.4 lb/lb st)

PERFORMANCE:

Normal cruising speed: BWB-1	M0.85
SAX-40	M0.8
Max approach speed, BWB-1	150 kt (278 km/h; 173 mph) EAS
Initial cruising altitude: BWB-1	10,665 m (35,000 ft)
SAX-40	12,190 m (40,000 ft)
T-O field length, BWB-1	3,353 m (11,000 ft)
Range: with 800 passengers, BWB-1	7,000 n miles (12,964 km; 8,055 miles)
with 215 passengers, SAX-40	5,000 n miles (9,260 km; 5,753 miles)

Southeast Asian investors had withdrawn and replacement(s) were being sought. Previously, Dirgantara had completed NMX preliminary design and wind tunnel testing by end of 2005, but then suspended detailed design work pending arrival of replacement funding. Assuming this to materialise soon, maiden flight could be retargeted for 2008. Eventually, AeroNimbus plans production of up to 36 a year at three separate plants.

COSTS: Dirgantara design and development contract valued at USD50 million; estimated unit price USD2.2 to 2.5 million (2005).

POWER PLANT: Twin Pratt & Whitney Canada turbojets/fans.

ACCOMMODATION: Pilot(s) and six passengers.

DIMENSIONS, EXTERNAL:

Length overall (approx)	16.0 m (52 ft 6 in)
-------------------------	---------------------

WEIGHTS AND LOADINGS:

Max T-O weight	approx 2,000 kg (4,409 lb)
----------------	----------------------------

PERFORMANCE (estimated):

Cruising speed	M0.8
T-O and landing run	800 m (2,625 ft)

e-mail: press@eads.net

SENIOR VICE-PRESIDENT, COMMUNICATIONS: Christian Poppe

Decision to merge Aerospatiale Matra of France and DASA of Germany was announced on 14 October 1999; previously mooted amalgamation of Spain's CASA with DASA was reconfirmed on 2 December 1999, increasing size of prospective company to 90 sites. Officially formed 10 July 2000, immediately becoming world's third-largest aerospace company. Asset distribution comprises 30.80 per cent stock flotation: 30.29 per cent directly, plus 2.75 per cent indirectly DaimlerChrysler; 5.53 per cent SEPI (Spanish state holding company); 30.29 per cent SOGEGADE (Lagard  re and French government jointly); and 0.34 per cent directly by French government.

EADS has five major operating divisions:

Airbus (International)
Military Transport Aircraft (Spain)
Eurocopter (International)

Defence & Security Systems Comprising EADS Military Aircraft (Germany), EADS Services, Missiles, EADS Systems & Defence Electronics and EADS Telecom

Space Company controls Socata and Eurocopter (100 per cent); also holds 80 per cent of Airbus, 56 per cent of Airbus Military Company and 51 per cent of EADS PZL in Poland; and has significant shares in Dassault (45.8 per cent), Eurofighter (43 per cent), ATR (50 per cent) and missile and space programmes. Aircraft produced by EADS are described in their

appropriate national sections with the exception of the Mako, which is first to bear the EADS name.

Wholly owned subsidiaries include EADS Socata, EADS EFW and EADS Sogerma Services.

Additionally, ATR is jointly owned with Alenia Aeronautica, EADS Russia founded 25 March 2004 as joint programme (subject to Russian law) principally concerned with research and production for Airbus.

Corporate headquarters established in Netherlands and EADS is subject to Dutch company

law. Turnover in 2004 totalled EUR31.761 million; orders€44.117 million; backlog at 1 January 2005 EUR114.288 million. Workforce 110,662 total; by division is approximately 38 per cent Airbus, 26 per cent Aeronautics, 20 per cent Systems and Defence Electronics, 11 per cent Space and 4 per cent Military Transport Aircraft; remaining 1 per cent are HQ staff. By 2012, EADS work distribution planned to be 60 per cent commercial, 30 per cent military and 10 per cent space.

The first aircraft — Mako advanced jet trainer — to have an EADS appellation appears to have made little progress towards first flight in recent years.

EADS/JAXA

JAPAN AEROSPACE EXPLORATION AGENCY

PARTICIPATING COMPANIES:

EADS: see France
Japan Aerospace Exploration Agency
Marunouchi Kitaguchi Building
1-6-5 Marunouchi, Chiyoda-ku, Tokyo 100-8260, Japan
Tel: (+81 3) 62 66 64 00
Fax: (+81 3) 62 66 69 10
Web: www.jaxa.jp

JAXA was created on 1 October 2003 by amalgamation of Japan's National Aerospace Laboratory (NAL), Institute of Space and Astronautical Science (ISAS) and National Space Development Agency (NASDA). Current projects include the Stratospheric Platform (SPF), a programme to develop a series of unmanned, geostationary stratospheric airships for telecommunications and other purposes, for which a low-altitude, subscale (67.8 m; 222.4 ft long) NiCT prototype was test-flown in 2004. It is also developing a next-generation supersonic transport, the NEXST-1, on which it was joined by EADS France in June 2005.



Low-altitude test airship for the SPF

1133972

EADS/JAXA NEXST-1

TYPE: Supersonic airliner.

PROGRAMME: Continues towards development of future supersonic transport for service entry in 2015 to 2020 time frame. Design begun as indigenous project in 1997 by National Aerospace Laboratory of Japan; first test flight attempted in 2002, using subscale model launched by solid-fuel booster rocket, but failed when model detached prematurely and crashed. Agreement signed with EADS 14 June 2005 for three-year, USD5.4 million joint development research into 300-passenger SST able to fly from New York to Tokyo in 6 hours.



Subscale test model of the EADS/JAXA NEXST-1

1151054

Second rocket-boosted test flight, with 11.5 m (37.7 ft) long unpowered model, made from Woomera Test Range in Australia 10 October 2005, was successful. Model separated from rocket at about 18,000 m (59,050 ft) and glide-flew at M1.9 to M2.0 for 15 minutes 22 seconds before descending by parachute.



Putative alternative 4-engined SST design

1151004



NEXST-1 test model, launched 10 October 2005

1151053

EUROCOPTER

EUROCOPTER SAS (AN EADS COMPANY)

Aéroport International Marseille-Provence, F-13725 Marignane Cedex, France
 Tel: (+33 4) 42 85 85 85
 Fax: (+33 4) 42 85 85 00
 Web: www.eurocopter.com
 PRESIDENT AND CEO: Lutz Bertling
 DIRECTOR OF COMMUNICATIONS: Xavier Poupardin
 CHIEF, PRESS & INFORMATION: Jean-Louis Espes

Eurocopter SA formed 16 January 1992 by merger of Aerospatiale and MBB (DASA) helicopter divisions. Share capital then held on two levels: Eurocopter Holding owned 60 per cent by Aerospatiale and 40 per cent by DASA; capital of Eurocopter SA held 75 per cent by Eurocopter Holding and 25 per cent by Aerospatiale. However, on 30 May 1997, the separate elements of Eurocopter were merged into a single management structure. Former Eurocopter France, Eurocopter International and Eurocopter Participations became a single entity (Eurocopter France, trading as Eurocopter), with Eurocopter Deutschland (in Germany) as a wholly owned subsidiary. Following formation of EADS, Eurocopter reconstituted on 18 September 2000 as simplified stock company (SAS) within EADS Aeronautics group. EADS CASA acquired 5 per cent share in December 2003, in return for relinquishing its share of Eurocopter España.

Eurocopter products cover 75 to 80 per cent of the range of helicopters in terms of size and capacity, but company intends to expand this to 95 per cent; aim set back by forced withdrawal from Euromil, particularly with co-operative development of Russian Mil Mi-38, but forthcoming EC 175 will fill market gap between EC 145 and EC 225. Orders in 2005 were 401: 44 Colibris, 193 Ecureuil/Fennec/EC 130s (variants not specified), 87 EC 135s, 20 BK 117/EC 145s, 25 Dauphin/Panther/EC 155s, 14 Super Puma/Cougar/EC 225/EC 725s, six Tigres and 12 NH90s. In 2006, delivered 381 helicopters and received orders for 615, valued at EUR3.52 billion: 59 Colibris, 257 Ecureuil/Fennec/EC 130s, 107 EC 135s, 80 Bk 117/EC 145s, 40 Dauphin/Panther/EC 155s, 29 Super Puma variants and 43 NH90s. By late 2006, Eurocopter fleet totalled more than 9,500 helicopters with 2,500 customers in 139 countries, these having flown more than 60 million hours.

Main production centres in France, Germany and Spain. Additionally, Eurocopter subsidiaries employ some 1,680 persons and deliver about 150 aircraft per year: managed by Eurocopter Subsidiaries and Participations division (ownership percentage in parentheses): American Eurocopter (370 personnel; 60 per cent); Eurocopter Canada (134 personnel; 100 per cent); Hélicabras (Brazil; 260 personnel; 76.5 per cent); Eurocopter Romania (55 personnel; 51 per cent); and McAlpine (UK; 132 personnel; 10 per cent); are all first-tier subsidiaries responsible for distribution, service and industrial work, including assembly and component manufacture (Canada and Hélicabras), customisation (American, Canada, Hélicabras and McAlpine) and repair and overhaul. Second-tier subsidiaries (distribution and service) comprise Eurocopter South East Asia (Singapore; 75), Eurocopter Mexico (100), Eurocopter Chile (100), Eurocopter South Africa (100), Australian Aerospace (Australia; 100), and Euroheli (Japan; 10) (with Eurocopter Japan in co-ordinating role. Service subsidiaries are Eurocopter Philippines (70), Eurocopter Malaysia (100) and COHC GAMEC (China; 21).

On 7 August 2003, American Eurocopter, with HQ at Grand Prairie, Texas, broke ground for a new, USD12 million plant at Columbus, Mississippi, for final assembly of up to 30 AStar/Ecureuils per year, plus manufacture of some AS 350, AS 355 and EC 120 components; FAA production approval obtained September 2005. Australian facility at Brisbane began assembly of 18 Tigres in April 2003 and assembly of EC 120s in June 2003. Tiger deliveries began 2005. In 2005, established EC 120 assembly line in China and announced launch of EC 175 development programme jointly with AVIC II. South Korea nominated Eurocopter as partner in KHP programme for 8-tonne helicopter in December 2005; Eurocopter assigned 30 per cent share in development and 20 per cent in production, plus 50 per cent of exports.

EUROCOPTER

Address as above.

Company headquarters and main production centre at Marignane (Marseille); works at La Courneuve (Paris). In 2005, these employed 5,650 and 750 personnel, respectively.

EUROCOPTER DEUTSCHLAND

Industriestrasse 4, Postfach 1353, D-86609 Donauwörth, Germany
 Tel: (+49 906) 710
 Fax: (+49 906) 71 40 11
 CHAIRMAN: Friedrich Dörhöfer
 MEDIA RELATIONS EXECUTIVE: Christina Gotzheim

Industrial concern in charge of production and support of products originating in German part of Eurocopter. Wholly owned subsidiary with plants at Donauwörth (3,464 personnel in 2005), Kassel (80) and Ottobrunn (655).

Current programmes are EC 135, BK 117C-1, EC 145 and Tiger; NH90 (industrialisation); also maintenance/upgrade work for CH-53G, Lynx and Sea King. Research and development programmes concentrate on noise abatement, fly-by-light technologies, all-weather capability of helicopters and optimisation of in-flight comfort and safety. Eurocopter Deutschland closely co-operates with other industrial partners in the aerospace industry as well as the German and French aerospace institutions DLR and ONERA, respectively.

Eurocopter Deutschland, the Federal Ministry of Defence and German Aerospace Research Establishment are jointly providing DM40 million to 50 million funding for development of **Helicopter Simulator for Technology, Operations and Research (HeSTOR)**, based on EC 135, to replace BO 105-based Advanced Technology Testing Helicopter System (ATTHEs) which was lost in an accident on 19 May 1995.

EUROCOPTER ESPAÑA SA

Carretera del Barrio de la Fortuna 10, E-28044 Cuatro Vientos, Madrid
 Tel: (+34 91) 379 72 00
 Fax: (+34 91) 508 39 58
 PUBLIC RELATIONS EXECUTIVE: Francisco Salido

Established 28 September 2000, replacing former subsidiary Helicopteros España (HESA). Works at Cuatro Vientos responsible for engineering, production and customer support, on par with French and German divisions. Owned 60 per cent Eurocopter and 40 per cent EADS CASA until 18 December 2003 announcement of CASA's buy-out in return for 5 per cent share of Eurocopter. Personnel total 250. Announced 12 May 2005 that Eurocopter will invest EUR60 million over 10 years to build 450-personnel plant at Albacete.

Additionally, Eurocopter has entered into two alliances with manufacturers in Asia in order to develop specific products. These are regarded by the company as wholly Eurocopter aircraft.

EUROCOPTER/CATC/ST AERO

PARTICIPATING COMPANIES

Eurocopter: International

CATC: China

Singapore Technologies Aerospace: Singapore

This partnership formed to develop the EC 120 Colibri, production of which is now fully under way. Shares are Eurocopter 61 per cent (and programme leader), CATC/HAMC 24 per cent and ST Aero 15 per cent.

EUROCOPTER/KAWASAKI

PARTICIPATING COMPANIES

Eurocopter: International

Kawasaki: Japan

Companies formed a partnership on 25 February 1977 to develop the BK 117 multipurpose helicopter. Low-rate production continues in both Germany and Japan. An upgraded version, the EC 145, was certified in December 2000.

EUROCOPTER 665 TIGER/TIGRE

TYPE: Attack helicopter.

PROGRAMME:

DEVELOPMENT MILESTONES

Requirement issued	1984
Design began	18 Sep 85
Programme launched	8 Dec 87
Official go-ahead	30 Nov 89
Rolled out	4 Feb 91
First flight	27 Apr 91
Production go-ahead	30 Jun 95
First flight, production	2 Aug 02
First delivery (Australia)	15 Dec 04

France and Germany agreed in 1984 to develop a common combat helicopter; Eurocopter Tiger GmbH formed 18 September 1985 to manage development and manufacture for French and German armies; was not a full member of Eurocopter because it was working on a single government contract; executive authority for programme is DFHB (Deutsch Französisches Hubschrauberbüro) in Koblenz; procurement agency is German government BWB (Bundesamt für Wehrtechnik und Beschaffung).

Original 1984 MoU amended 13 November 1987; FSD approved 8 December 1987; main development contract awarded 30 November 1989, when name Tiger (Germany)/Tigre (France) adopted; five development aircraft built, including three unarmed aerodynamic prototypes, used also for core avionics testing (PT1, 2 and 3), one (PT4) in HAP (initially called Gerfaut) configuration and one (PT5) as UHT prototype; PT1 rolled out 4 February 1991; first flight 27 April 1991; fifth prototype flew on 21 February 1996, at which time the first four aircraft had accumulated 1,090 flying hours; further details below: total of 2,869 hours flown by five prototypes up to June 2001. Germany confirmed purchase of full 212 required, 1994, having considered cut to 138, but later reconsidered.

Industrialisation phase brought forward by two years to strengthen export prospects and Franco-German MoU signed 30 June 1995; timetable then was first deliveries in 1999 to France (approximately 10) and for export, but France announced spending moratorium in November 1995, postponing authorisation of further funding commitments until signature of a FFr2.5 billion (DM733.6 million) production investment contract on 20 June 1997. Deliveries then expected in 2001, but further delayed to July 2003 (for HAP; 2011 for HAC) by May 1996 defence plan, which envisaged procurement of only 25 Tigres in 2000–2002 budgets.

On 20 May 1998, France and Germany signed a commitment to order an initial joint batch of 160 Tigres. However, planned late 1998 placing of contracts was delayed by requirement of new German government to conduct a defence review; options included delaying ISD; or reducing numbers; or even cancelling UHT and procuring French HAP version. Production contract was finally signed on 18 June 1999 for the full 160 aircraft; first deliveries in 2002. HAP deliveries to include two in 2003, eight in 2004 and 10 per year in 2005–10; first production aircraft (9826) flew in Germany, 2 August 2002. First deliveries to France (FMATA c/n 001) on 16 March 2005 (official ceremony 18 March) and to Germany 7405 (c/n 1005) on 6 April 2005, although nominal initial recipient was Australian Army, which accepted first two at Oakley, Queensland, on 15 December 2004



Eurocopter Tiger UHT

1153746



First Australian-built Eurocopter Tiger

1153747

(following acceptance by Australian Aerospace at Brisbane on 23 November 2004); however, official acceptance by Australian Army was 18 July 2005. Production of the first batch of 320 engines (plus 12 spares) began during 2000, and will continue through 2011. June 1999 contract also formalised German contract change from PAH2 to UHT and French change from HAP to HAP-F (*Finalisé*).

Spain became third member of Tiger programme in 2003 and integrated in airframe, engine, avionics and weapons development and manufacturing programmes. Spanish Army (and France) to receive HAD version of Tigre, for which development contract signed 8 December 2004.

Joint team at Marignane is flight testing basic helicopter, updating avionics during trials, and testing HAP variant; similar team at Ottobrunn is qualifying basic avionics. Euromep mission equipment package, and integrating weapons system. Rotor downwash problems resulted in trial forward positioning of horizontal stabiliser; by mid-1994 definitive solution adopted of reversion to original position, but halving area. By January 1998, the design had been frozen, and the development programme was more than 90 per cent complete. Development of HAD version involves Spanish participation from 2003 onwards.

First export order for Tiger confirmed 14 August 2001, when Australia announced selection to meet AIR 87 requirement. MoU on co-operation and exchange of information, to lead to production and delivery, signed by Eurocopter and Australian Defence Science and Technology Organisation on 12 July 2002.

CURRENT VERSIONS (general): Original partners require three versions in two basic configurations with about 80 per cent commonality: **U-Tiger** is basis of the UHT and HAC, both with mast-mounted sight and Trigat missiles; **HCP** (*Helicoptère de Combat Polyvalent*) is basis of the HAP (roof sight and turreted gun). Other variants proposed to meet export requirements.

Tigre HAP: *Helicoptère d'Appui et de Protection*; name Gerfaut dropped late 1993; escort and fire support version for French Army; armed with 30 mm Giat AM-30781 automatic cannon in undernose turret, with 150 to 450 rounds of ammunition; four Mistral air-to-air missiles and two pods each with twenty-two 68 mm unguided TDA rockets delivering armour-piercing darts, mounted on stub-wings, or 12-round rocket pod instead of each pair of Mistrals, making total of 68 rockets; roof-mounted sight, with TV, FLIR, laser range-finder and direct view optics sensors; image intensifiers integrated in helmets; and extended self-defence system. HAP configuration was approved by late 1998, permitting type qualification in December 2002 and official military (DGA) certification on 19 March 2004, followed by OCCAR (European arms procurement agency) certification on 30 March. Deliveries from Marignane began 16 March 2005; final (37th) aircraft due in 2008.

UHT: *Unterstützungshubschrauber Tiger* (previously designated UHU); German Army multirole 'utility' or multirole anti-tank and fire-support helicopter; replaces dedicated anti-tank PAH-2 Tiger; final assembly at Donauwörth. Type qualification due December 2002, but not achieved until 17 August 2004, with OCCAR approval next day; this approval for Step 1 configuration with Stinger, cannon, HOT 3 and TriGAT. Step 2, for operational training in France, adds passive missile warning; Step 3, in mid-2006, for operational regiment, includes encrypted communications. Underwing pylons for HOT 3 or (from 2006) Trigat missiles. Stinger self-defence missiles, unguided rockets, gun pod and extended self-defence system; mast-mounted TV/FLIR/laser ranger sight for gunner; nose-mounted FLIR for piloting. A mid-life upgrade for the UHT may integrate the Mauser 30 mm gun in a chin turret which traverses $\pm 140^\circ$ in azimuth and from $+20^\circ$ to -45° in elevation.

Tigre HAC: *Helicoptère Anti-Char*; anti-tank variant originally required by, but not yet ordered for French Army; final assembly at Donauwörth. Type qualification due in third quarter of 2011; same weapon options (except Mistral AAM in place of Stinger), mast-mounted sight and pilot FLIR system as UHT. A mid-life upgrade to the HCP could see addition of a mast-mounted automatic air surveillance and warning system, in the form of DAV pulse Doppler radar, together with HUMS and an IR jammer.

Export: A basic export version combining features of French and German versions; offered (unsuccessfully) to UK and Netherlands.

ARH Tiger (HCP): Hybrid Tiger variant to meet Australian Army Air 87 Requirement. Based on French HAP, with undernose Giat 30-781 30 mm cannon, roof-mounted sight and provision for underwing 70 mm rocket pods, but with added anti-tank capability. Australia also requires integration of the AGM-114 Hellfire ATM. Maximum mission weight of 6,100 to 6,300 kg (13,448 to 13,889 lb). AS1,300 million (US\$674 million) contract for 22 signed 21 December 2001. First four from European production; fuselage sections of first aircraft joined 11 February 2003; first flight (F-ZVLH/A38-001) 20 February 2004 at Marignane.

HCP Tiger (HCP): Export version based on French Army HAP with the same undernose gun turret and roof-mounted sight, HOT 3 and Trigat missiles; Hellfire optional. Strix roof sight (direct view optics optional) and additional laser designator plus video signal interfacing for Trigat operation. Either Mistral or Stinger air-to-air missiles. A mid-life upgrade to the HCP could see addition of a DAV mast-mounted air surveillance radar (pulse Doppler type) or a mast-mounted MMW radar for automatic ground and air surveillance. No gun pod option.

Tigre HAD: *Helicoptère d'Appui-Destruction*. Multirole version for anti-tank, combat support, reconnaissance and escort roles; development cost estimated as EUR152 million (2002). Purchased by Spain. Upgraded (MTR390-E) engines, increased MTOW to 6 tonne class, roof sight for Trigat ATMs. Additional weapons include 30 mm cannon, Mistral AAMs and 70 mm unguided rockets. HAD adopted by France in 2003, with final 43 of order for 80 Tigres to be delivered from 2010 onwards. Programme launched by instruction to proceed (ITP) on 8 December 2004, following agreement by participating countries signed 26 October 2004 empowering OCCAR to place development contracts on their behalf. OCCAR; formal contract signed 30 November 2005.

Tiger T800: LHTEC T800 or CTS800 engines proposed as an engine option for the Tiger. Turkey is sales prospect, as Army has reservations about growth potential of MTR390.

CURRENT VERSIONS (specific): **PT1/F-ZWWW:** Aerodynamic prototype; basic avionics; first flight 27 April 1991. Successively fitted with aerodynamic mockups of mast-mounted and roof-mounted sights, nose-mounted gun and weapon containers. Relegated to ground fatigue testing and static display in early 1996 on completion of flight programme. Flown 502 hours.

PT2/F-ZWWW: HAP aerodynamic configuration; full core avionics; rolled out 9 November 1992; first flight 22 April 1993. Used for radar cross-section and detectability tests. Retrofit with HAP systems completed in November 1996; redesignated PT2R. Mistral launch trials at Landes ranges 14/15 December 1998; technical assessment by French Army at Valence between 17 May and 3 June 1999; rocket qualification, June 1999. Used for HAP version qualification (redesignated PT2R2) at Landes test centre between 4 April and 12 May 2000. Redesignated PT2X in 2001 to serve as multimission demonstrator, adding LFK/SAGEM sighting system for HOT 3 anti-tank missiles in addition to original Mistral missiles and rockets. Deck landing trials, May 2002, aboard FS *Sirocco*, an amphibious landing ship. Demonstrated autorotation at 5,700 kg (12,566 lb) 27 April 2004.

PT3/9823: Full core avionics (including navigation and autopilot); first flight (as F-ZWWT) 19 November 1993. Retrofit with UHT systems began in February 1997; redesignated PT3R; Euromep C' (see Avionics) from late 1997, HOT launches with mast sight at extreme range in night and smoke conditions, June 1999; hot weather trials at Bateen AB in Abu Dhabi September 1999. Moved back to France for HAC development.

PT4/F-ZWWU: HAP aerodynamic configuration and avionics (including roof sight, HUD and Topowil helmet sight; first Tiger with live weapons system); first flight 15 December 1994. Sighting system trials early 1995; Giat cannon trials (15 ground-based tests) completed at Toulon, April 1995; full testing began at CEV Cazaux, 21 September 1995 and, by late November, had demonstrated airborne cannon firing and launch of Mistral AAM (without seeker); by 1 January 1997 had fired eight Mistrals, 3,000 cannon rounds and 50 rockets; 1997 trials included two more Mistrals, rockets and tests of gun controls. Painted in three-tone disruptive camouflage. Winter trials in Sweden, early 1997 with skid/skis landing gear. Flown 296 hours to 1 December 1997; crashed during night low-level evaluation by Australian Army 17 February 1998.

PT5/9825: Full UHT avionics; first flight 21 February 1996. Undertook German Army weapon trials (Stinger, HOT 2 and 12.7 mm podded gun) in 1997 including the firing of six HOT 2s using Euromep Osiris mast-mounted sight. Retrofitted as PT5R with production-standard weapon system; first flight 8 October 1999. Weapon trials continued into 2004, including HOT, Trigat, 70 mm rocket and 12.7 mm machine gun.

PT6 and PT7: Static test airframes for fatigue and crash-resistance trials.

PS1/F-ZVLJ: Pre-series HAP built at Marignane on production tooling; laid down in third quarter of 1998; first flight 21 December 2000. Tasks include validation of production methods and planned production configuration including 6.4 tonne MTOW extension. Operated by French Army aviation trials centre (GamStaT) at Valence.

UHT S01/9826: First true production aircraft; planned to fly on 1 March 2002, but not rolled out until 22 March; first flight 2 August 2002; used for six-month techeval/opeval trials, replacing PT5R. Pilot's visual system trials.

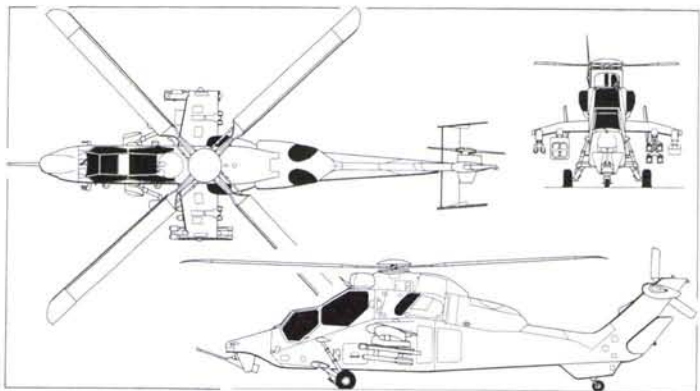
UHT S02/9812: Electromagnetic compatibility trials at WTD 81. Greding; weapons qualification.

UHT S03/9813: To WTD 61. Manching, for instructor training (with S04).



Eurocopter Tigre HAP PS1 (Paul Jackson)

1153745



Eurocopter Tigre HCP combat escort and fire support helicopter (Paul Jackson)

0507609

HAP S01: First production French Tiger, first flight (F-ZKDB) 26 March 2003; then briefly to CEV trials centre 1 April 2004; then French Army.

CUSTOMERS: Firm orders by early 2004 totalled 206: France and Germany 80 each; Australia 22 and Spain 24.

Original requirement was for 427 (France 75 HAP and 140 HAC, Germany 212 PAH-2); UHU (later UHT) version substituted for PAH-2s in 1993; French order amended by 1994 to 115 HAP and 100 HAC but may be reduced further; in mid-2001 French Army expressed preference for multirole Hélicoptère d'Appui-Destruction (HAD) version in place of two subvariants now on order. Germany committed to 212, of which 112 to be funded between 2001 and 2009; initial commitment of 20 May 1998 confirmed 80 each by France (70 HAP, 10 HAC) and Germany (80 UHT), as agreed by Franco-German Security Council on 9 December 1996. By 2002, official German sources suggesting full requirement only 110 and Eurocopter resigned to total of 240 between two launch partners. Confirmed in 2003 that France's initial order for 80 Tigres now to be 40 HAPs and 40 HADs (no HACs), although this change was not due for formal embodiment in contracts until 2006. First operational squadron (April 2006) to be formed within 5 Combat Helicopter Regiment (5 RHC) at Pau, gaining IOC mid-2007. Further French order in 2011 for 20 Tigres satisfies current defence plan. Second regiment will be at Etain.

Germany's Tigres are required to equip four 48-aircraft regiments, each supporting an Army division, first being 1 Staffel of 36 Regiment at Fritzlar and second at Roth.

Joint training school at le Luc opened 1 July 2003 as the Ecole Franco-Allemand, or EFA with a Thomson Training and Simulation/STN Atlas aircrew training system, including six-axis motion simulators and wide-angle visual systems. Training course lasts 28 weeks for a crew chief, or 19 weeks for a pilot. Fleet of 14 German and 14 French Tigres assigned by 2006, with eleven simulators; deliveries began 2005. In October 2000 there were reports that the German MoD was considering reducing its Tiger buy to 100 helicopters.

Australia selected Tiger for AIR 87 requirement on 14 August 2001; contract signed 21 December 2001 for 22 helicopters, of which final 18 assembled by Australian Aerospace at Brisbane, from where deliveries due between July 2005 and April 2008. First French-built components arrived at Brisbane 31 March 2003 and assembly work began on 10 April. Four complete French aircraft deliverable in pairs, December 2004 and early 2005, initial Marignane-built helicopter having flown on 20 February 2004 (temporarily as F-ZVLH). First two French Tigres delivered to Australian Aerospace on 23 November 2004 and nominally accepted by Australian Army on 15 December 2004. First Australian-assembled Tiger (A38-005) flew at Brisbane 21 December 2004. Following familiarisation flying at Oakey, Tiger formally accepted by Australian Army on 18 July 2005. First operational squadron forms at Darwin in June 2007.

Spanish government approval for €1,353 million purchase of 24 Tigres given 5 September 2003, price including logistic support and initial weaponry. Programme involves Spanish participation in Tiger through Eurocopter España; Spain designated sole source of all tailbooms and will assemble chosen HAD version; other Spanish firms to participate in overall Tiger programme, including engine (ITP), avionics (INDRA) and Trigat missile (LFK, INDRA, SENER and IZAR). Initial six HAP Tigres delivered in 2004-05, but earmarked for later conversion to HADs. Development of HAD configuration and integration of Spanish companies in Tiger programme to take four years before production begins of 18 HADs in Spain for 2007-11 delivery. HAD development contract signed 8 December 2004.

COSTS: Tiger current development cost, shared equally by France and Germany, reported DM2.2 billion. Production tooling cost Ffr2.6 billion (US\$500 million) (1996). Unit cost (1996) for UH estimated as US\$11 million, including launchers and all government-furnished equipment. Initial batch of 160 assigned Ffr21.5 billion, of which Ffr13 billion for 80 German helicopters and Ffr8.5 billion for 80 French (1998). Australian programme unit cost US\$30.6 million (2001).

DESIGN FEATURES: Robust, tandem-seat design with pylon-mounted armament, representing current combat helicopter style, FEL (fibre elastomer) main rotor designed for simplicity, manoeuvrability and damage tolerance; has infinite life except for inspection of elastomeric elements at more than 2,500-hour intervals; hub consists of titanium centrepiece (including duct for mast-mounted sight) with composites starplates bolted above and below; flap and lead/lag motions of blades allowed by elastic bending of neck region and pitch change by

elastic part of elastomeric bearings; lead/lag damping by solid-state viscoelastic damper struts faired into trailing-edge of each blade root; equivalent flapping hinge offset of 10.5 per cent gives high control power; SARIB passive vibration damping system between transmission and airframe; three-blade Spheriflex tail rotor has composites blades with fork roots; built-in ram air engine exhaust suppressors.

FLYING CONTROLS: Fully powered hydraulic flying controls by SAMM/Liebherr; Labinal/Electrometal servo trim; horizontal tail mounted beneath tail rotor; autopilot is part of basic avionics system (see under Avionics heading).

STRUCTURE: 80 per cent CFRP, block and sandwich and Kevlar sandwich; 6 per cent titanium and 11 per cent aluminium; airframe structure protected against lightning and EMP by embedded copper/bronze grid and copper bonding foil; stub-wings of aluminium spars with CFRP ribs and skins; titanium engine deck may be replaced by GFRP; airframe tolerates crash impacts at 10.5 m/s (34.4 ft/s) and meets MIL-STD-1290 crashworthiness standards; titanium main rotor hub centrepiece and tail rotor Spheriflex integral hub/mast; blade spars filament-wound; GFRP, CFRP skins and subsidiary spars and foam filling.

French plants building transmission, tail rotor, centre-fuselage (including engine installation), aerodynamics, fuel and electrical systems, weight control, maintainability, reliability and survivability; Eurocopter Deutschland responsible for main rotor, flight control and hydraulic systems, front and rear fuselage (including cockpits), prototype assembly, flight characteristics and performance, stress and vibration testing and simulation.

LANDING GEAR: Tailwheel type, non-retractable, with single wheel on each unit. Designed to absorb impacts of up to 6 m (20 ft)/s. Main gear by Messier-Bugatti, tail gear by Liebherr Acrotechnik.

POWER PLANT: Two MTU/Rolls-Royce/Turbomeca MTR 390 modular turboshaft engines mounted side by side above centre-fuselage, divided by armour plate 'keel' (engine first flown in Panther testbed 14 February 1991); power ratings are maximum T-O 958 kW (1,285 shp), super emergency 1,160 kW (1,556 shp), maximum continuous 873 kW (1,171 shp). MTR 390 Enhanced, with additional 14 per cent power, to be installed in 38th and subsequent French Tigres and all Spanish aircraft. LHTEC has proposed the T800-801 as a potential alternative power plant for export variants of the Tiger.

Self-sealing crashworthy fuel tanks, with explosion suppression and with non-return valves which minimise leakage in a crash; total capacity 1,360 litres (359 US gallons; 299 Imp gallons). Provision for two external tanks, one on each inboard pylon, each of approximately 350 litres (92 US gallons; 77 Imp gallons) capacity. Gearbox has specified 30 minutes' dry running capability (demonstrated 65 minutes, November 1994).

ACCOMMODATION: Crew of two in tandem, with pilot in front and weapons system operator at rear; full dual controls; both crew members can perform all tasks and weapon operation except that anti-tank missile firing only available to gunner. Armoured, impact-absorbing seats; stepped cockpits, with flat-plate windscreens and slightly curved non-glint transparencies.

SYSTEMS: Redundant hydraulic, electrical and fuel systems. Primary power generation by two 20 kVA alternators; DC power generation by two 300 A 28 V transformer/rectifiers and two 23 Ah Ni/Cd batteries.

Dual redundant AFCS provides four-axis command and stability augmentation. Basic AFCS modes: attitude hold, heading hold. Higher AFCS modes: Heading/acquire/hold, barometric altitude capture/hold, altitude acquire, airspeed hold, vertical speed acquire/hold, nav coupling, radar height hold, Doppler hover hold, line of sight acquisition/hold. Other AFCS functions: gun recoil force compensation, axis decoupling and tactical mode (follow-up trim on override of break-out forces).

AVIONICS: Basic or core avionics common to all three versions include bus/display system, com radio (French and German systems vary), autonomous nav system and radio/Doppler nav aids. Thales TSC 2000 IFF Mk 12, NH 90-based ECM suite (including laser warning) and AFCS, all connected to and controlled through redundant MIL-STD-1553B data highway.

Flight: Navigation system, by Thales, Teldix and EADS, is fully redundant; system contains two Thales PIXYZ three-axis ring laser gyro units, two air data computers, two magnetic sensors, one Teldix/BAE Canada CMA 2012 Doppler radar, a radio altimeter and GPS providing data to Dornier EuroGrid digital map system; these sensors also provide signals for flight control, information display and guidance; integrated duplex AFCS by Thales and Nord Micro; AFCS computers produced by Thales, VDO-Luft and Litef.

Instrumentation: Colour liquid crystal flight displays showing symbology and imagery (two per cockpit for flight and weapon/systems information) by Thales and VDO-Luft; each crewman has central control/display unit for inputting all radio, electronic systems and navigation selections; digital map display system by Dornier and VDO-Luft (incorporating NH 90's Eurogrid map generation system); engine and systems data are fed into the databus for in-flight indication and subsequent maintenance analysis. BAE Systems Knighthelm fully integrated day and night helmet ordered for German Tigres; French Tigres have similar Thales Topowl helmet-mounted sights, with integrated night vision (image intensifiers), FLIR, video and synthetic raster symbology.

Mission: Euromep (European mission equipment package) includes SATEL Condor 2 pilot vision subsystem (PVS), air-to-air subsystem (Stinger or Mistral), mast-mounted sight and missile subsystem and Euromep management system all connected to separate MIL-STD-1553B data highway. Euromep Standard B avionics first flew February 1995 (PT5); Standard C testing began in late 1997 (PT3R). PVS has 40 x 30° instantaneous field of view (with ±110 x 35° total field of view) thermal imaging sensor steered by helmet position detector giving both crewmen day/night/bad weather vision, flight symbology and air-to-air aiming in helmet-mounted display; mast-mounted sight, gunner sight electronics and gunner's head-in target acquisition display and ATGW 3 subsystem connected by separate data highway; HOT 3 missile system also available. Thales armament control panel and fire-control computer.

TIGER WEAPON SYSTEM OPTIONS

Version	Primary weapon systems	Optional weapon systems
HAP	Turret-mounted 30 mm cannon Strix roof sight Helmet sight and clear sight (x2)	Two pods, 22 each 70 mm rockets plus two pods, 12 each submunitions rockets; or four Mistral AAMs; or four Mistral AAMs plus two pods, 22 each 70 mm rockets
HAC	Osiris roof sight Helmet sight/display (x2)	Eight HOT ATMs plus four Mistral AAMs; or eight Trigat ATMs plus four Mistral AAMs; or four Trigat ATMs plus four HOT ATMs plus four Mistral AAMs
UHT	Osiris roof sight Helmet sight/display (x2)	Four Stinger AAMs plus two 12.7 mm gun pods; or eight HOT or Trigat (or HOT/Trigat mix) ATMs; or two pods, 19 each 70 mm rockets
ARH	Turret-mounted 30 mm cannon Roof sight and laser designator/helmet sight Mistral AAM capability	Two Hellfire ATMs plus 26 off 70 mm rockets; or four Hellfire ATMs plus 33 off 70 mm rockets
HAD	Turret-mounted 30 mm cannon Roof sight Helmet sight/display (x2)	Four Mistral AAMs; or four pods of 68 mm or 70 mm rockets; or four Trigat ATMs

HAP combat support mission equipment package includes SFIM STRIX gyrostabilised roof-mounted sight (with IR/CCD IR channel) above rear cockpit; includes direct view optics with folding sight tube, television and IR channels and laser ranger/designator.

Self-defence: EADS C-model EW suite (as in NH90) is one element in HAP's fully integrated avionics suite. This has an EADS laser warning receiver, EADS/LFK AN/AAR-60 missile launch warning device (*Lenkflugkörperysteme*) and Thales EW processor and radar warning receiver. Also chaff and flare dispensers (with 32 cartridges, sequenced by a Saphir M system). UH is similar, but with option of fitting IR jammer.

ARMAMENT: See also accompanying table. Tiger has four outboard weapon stations for typical four HOT, four Trigat, two Mistral or Stinger launchers or pods of 12 or 22 rockets; optional 12.7 mm gun pod with 250 rounds or auxiliary fuel tank. HCP (HAP) has all: include one 30 mm Giat AM-30781 automatic cannon with up to 450 rounds (traversing from +33 to -30° in elevation and through ±90° in azimuth). Hellfire ATM on Australian aircraft.

DIMENSIONS, EXTERNAL (UT: UHT and HAC, HCP: HAP, where different):

Main rotor diameter	13.00 m (42 ft 7 3/4 in)
Tail rotor diameter	2.70 m (8 ft 10 1/4 in)
Length overall, rotors turning	15.80 m (51 ft 10 in)
Length of fuselage: excl cannon	14.08 m (46 ft 2 1/4 in)
incl cannon	15.00 m (49 ft 2 1/2 in)
Height: to top of rotor head	3.83 m (12 ft 6 3/4 in)
to top of tail rotor disc	4.32 m (14 ft 2 in)
to top of mast sight (UT only)	5.20 m (17 ft 0 3/4 in)
Width over weapon pylons	4.52 m (14 ft 10 in)
Wheel track	2.38 m (7 ft 9 3/4 in)
Wheelbase	7.65 m (25 ft 1 in)

AREAS:

Main rotor disc	132.70 m ² (1,428.7 sq ft)
Tail rotor disc	5.72 m ² (61.63 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: HCP	4,200 kg (9,259 lb)
UT	4,350 kg (9,590 lb)
Max useful load: HCP	1,800 kg (3,968 lb)
UT	1,650 kg (3,638 lb)
Fuel weight: internal	1,080 kg (2,381 lb)
external (two tanks)	555 kg (1,224 lb)
Max T-O weight: normal	5,925 kg (13,062 lb)
alternate	6,000 kg (13,227 lb)
Max disc loading (alternate mission T-O weight)	45.2 kg/m ² (9.26 lb/sq ft)

PERFORMANCE (UT and HCP, as above):

Never-exceed speed (VNE):	
UHT, HAC	171 kt (298 km/h; 185 mph)
HCP, HAP	175 kt (322 km/h; 200 mph)
Max level speed: UT	140 kt (259 km/h; 161 mph)
HCP	150 kt (278 km/h; 173 mph)
Cruising speed	124 kt (230 km/h; 143 mph)
Max rate of climb at S/L: UHT	642 m (2,106 ft)/min
HAP	690 m (2,263 ft)/min
Vertical rate of climb at S/L: UHT	312 m (1,023 ft)/min
HAP	384 m (1,259 ft)/min
Hovering ceiling OGE: UHT	3,200 m (10,500 ft)
HAP	3,500 m (11,480 ft)
Range: on internal fuel	432 n miles (800 km; 497 miles)
with ferry tanks	691 n miles (1,280 km; 795 miles)
Endurance: operational mission	2 h 50 min
max internal fuel	3 h 25 min

EUROCOPTER HTH

TYPE: Heavy lift helicopter.

PROGRAMME: Offered in response to Franco-German heavy transport helicopter (HTH) requirement for which request for information issued in 2006. Proposed manufacture in Germany. International partners being sought ahead of expected 2010 launch decision; IOC in 2020.

CUSTOMERS: Anticipated Franco-German requirement for 200.

DESIGN FEATURES: Seven-blade main rotor; four-blade tail rotor. Service life 30 years or 15,000 hours; intended mission reliability rate of 97.5 per cent.

FLYING CONTROLS: Fly-by-wire.

STRUCTURE: Carbon fibre frames, beams and longerons; hybrid Nomex skins and bulkheads.

LANDING GEAR: Tricycle type. Twin wheels on each unit.

POWER PLANT: Three turboshafts, each 5,000 kW (6,705 shp).

ACCOMMODATION: Up to 66 combat-equipped troops. Internal dimensions accommodate German Wiesel scout car and French VAB armoured vehicle.

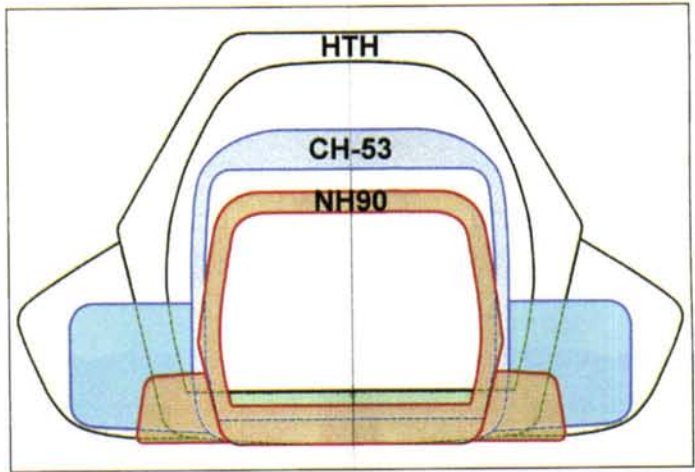
DIMENSIONS, EXTERNAL:

Fuselage: Length	24.20 m (79 ft 4 3/4 in)
Width at cabin	3.90 m (12 ft 9 1/2 in)
Height overall	9.00 m (29 ft 6 1/4 in)



Artist's impression of proposed Eurocopter HTH

1159307



Eurocopter HTH hold cross-section compared to other transport helicopters

1159322

DIMENSIONS, INTERNAL:

Cabin: Length	9.10 m (29 ft 10 1/4 in)
Max width	3.10 m (10 ft 2 in)
Max height	2.75 m (9 ft 0 3/4 in)

WEIGHTS AND LOADINGS:

Max payload	13,000 kg (28,660 lb)
Max T-O weight	36,000 kg (79,366 lb)

EUROCOPTER SUPER PUMA Mk I AND COUGAR Mk I

Spanish military designations: HD.21 and HT.21

Swedish Air Force designation: Hkp 10

TYPE: Multirole medium helicopter.

PROGRAMME: First flight of AS 332 Super Puma (F-WZJA) 13 September 1978; six prototypes; deliveries began mid-1981; present version powered by Turbomeca Makila 1A1 introduced 1986; military versions renamed Cougar in 1990; first AS 332L (stretched fuselage) certified to French IFR Cat. II 7 July 1983 and delivered to Lufttransport of Norway; certified for flight into known icing 29 June 1983; FAA Cat. II certification with SFIM CDV 85 P4 four-axis AFCS and FAR Pt 25 Appendix C known icing clearance. Mk I continues in production as long as orders (mainly making good attrition) continue.

Some AS 332/532s built under licence by IPTN in Indonesia and TAI in Turkey; some assembled by CASA in Spain; and some equipped by F+W (now SF) in Switzerland. Super Puma/Cougar worldwide fleet had accumulated 2,662,000 hours by January 2004.

CURRENT VERSIONS: Designation suffixes: U: military unarmed utility, A: armed, S: anti-ship/submarine, C: military court (short) fuselage, L: long fuselage, military or civil.

AS 332L1 Super Puma: Standard Mk I civil version with long fuselage and airline interior for 20 passengers; UK CAA IFR certification 21 April 1992.

AS 532 Cougar 100: Simplified 9 tonne tactical transport; fixed landing gear reduces cruising speed by 5 kt (9 km/h; 6 mph); price reduced by 15 to 20 per cent. External tanks cannot be fitted. Two versions are proposed: **AS 532UB** Short fuselage version and **AS 532UF** stretched fuselage version.

AS 532UC Cougar: Military Mk I short fuselage unarmed utility; seats up to 21 troops and two crew; cabin floor reinforced for 1,500 kg/m² (307 lb/sq ft). Crashworthy self-sealing fuel tanks standard. Equipment includes IR suppressors, RWR, chaff dispensers, flare launcher and armoured protection for crew and troops.

AS 532UL Cougar: Military Mk I unarmed long fuselage version; cabin lengthened by 0.76 m (2 ft 6 in); extra fuel and two large windows in forward cabin plug; carries up to 25 troops and two crew. Crashworthy self-sealing fuel tanks standard. Equipment as per AS 532UC; sliding forward cabin doors can be fitted to allow carriage of forward-firing 7.62 mm machine guns.

AS 532AC Cougar: Armed AS 532UC (Mk I).

AS 532AL Cougar: Armed AS 532UL (Mk I).

AS 532SC Cougar: Naval short Mk I version with ASW/ASV equipment; folding tail rotor pylon and main rotor blades; deck harpoon landing aid. Crew of two plus up to two operators.

AS 532UL Horizon: Battlefield surveillance radar helicopter; flight trials of small Orphée radar under an AS 330B Puma started 1986; French Army wanted 20 AS 532 Cougar Mk II fitted with radar, dedicated ECM and datalink (Orchidée programme). First flight of



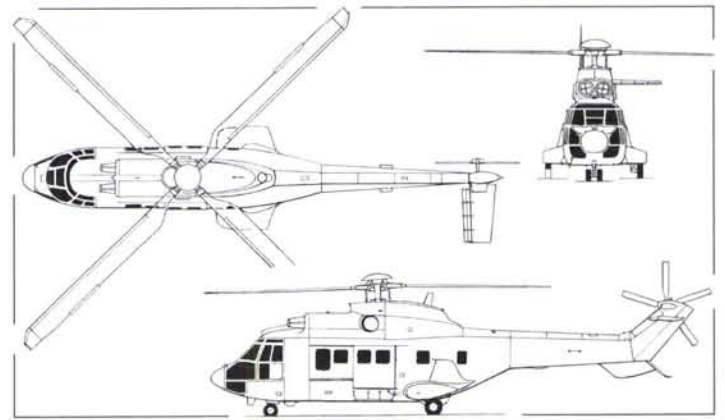
Eurocopter AS 332L1 Super Puma operated in China (Patrick Penna)

1040535



Military Eurocopter AS 532 Cougar Mk 1 (Patrick Penna)

1040536

Eurocopter AS 532UL Cougar (long-fuselage military Mk I unarmed utility)
(Dennis Punnett)

0507158

full-scale AS 532/Orchidée June 1990; programme cancelled for budgetary reasons August 1990; prototype without datalink flew 24 missions in Gulf War February 1991 in Operation Horus.

Horizon programme (*Hélicoptère d'Observation Radar et d'Investigation sur Zone*) with more effective operational concept and reduced development costs replaced Orchidée; development contract awarded to Eurocopter October 1992 for two (later increased to four) AS 532UL Horizons with same radar capabilities and ECM as Orchidée, but in AS 532UL Cougar Mk I, with standard ECM and longer mission endurance. Antenna rotates at either 2° 24' or 8°/s; radar range 108 n miles (200 km; 124 miles) with helicopter cruising at 97 kt (180 km/h; 112 mph) at 4,000 m (13,120 ft); normal operational range is 81 n miles (150 km; 93 miles); target speed resolution is 2 m (6.6 ft)/s. Military features include jet efflux deflector/diluters, anti-icing systems, NVG-compatible cockpit lighting, weather radar, encrypted communications, INS/GPS and active/passive countermeasures. First flight Horizon with full radar 8 December 1992; first delivery 24 June 1996; second (plus a ground station) in December 1996; third delivered in 1997 and fourth (plus second ground station) in 1998.

AS 332L Super Puma Mk II: Stretched version with Spheriflex rotor heads, new cockpit, enlarged rotors and more powerful Makila 1A2 engines. *Described separately.*

AS 532U2/A2 Cougar Mk II: Stretched version with Spheriflex rotor heads, new cockpit, enlarged rotors and more powerful Makila 1A2 engines. *Described separately.*

CUSTOMERS: Total orders for AS 332/532 and EC 225/725 series stood at 652, from 85 customers in 47 countries, by December 2002. Sales in 2003 totalled eight. Combined sales of Super Puma/Cougar/EC 225 EC 725 totalled 15 in 2004 and 14 in 2005. Some 110 AS 332L1/L2 Super Pumas in civil offshore oil industry support operations; French military orders include six for French Air Force (three for nuclear test facilities in Pacific and three for government VIP flying); French Army (ALAT) has supplemented SA 330 Pumas with AS 532 Cougars; 22 delivered to *Force d'Action Rapide* between late 1988 and end 1991.

Export customers include Abu Dhabi (eight including two VIP of which five to be upgraded with Exocet, sonar and torpedoes under 1995 contract), Brazil (25 including six AS 532SCs, one AS 332M1 and eight ordered January 2001), Bulgaria (12 AS 532 AL Cougars ordered in January 2005 for delivery over a three-year period); Cameroon (one), Chile (army, two; navy, four AS 532SCs), China (six), Ecuador (eight including six army), Finland (three for border police), Gabon (two, Presidential Guard), Germany (three, border police), Greece (Ministry of Merchant Marine, four ordered August 1998 and first two delivered 21 December 1999; remaining pair March 2000), Greek Air Force (four plus two options in 2001 for delivery between 2001 and 2003); Indonesia (built under licence: see IPTN entry); Japan (three, army/VIP), Jordan (eight), South Korea (three army/VIP, one AS 332L1), Mexico (two VIP), Nepal (two, Royal Flight), Nigeria (two), Oman (two, Royal Flight), Panama (one VIP), Saudi Arabia (12 AS 532SCs), Singapore (36), Slovenian Army (two Uls delivered 2003), Spain (10 SAR HD.21s, four VIP HT.21s/HT.27s, 18 army tactical transport HT.21s plus 15 AS 532ULs ordered February 1996 and delivered from 1998), Sweden (12 SAR), Switzerland (15 AS 332Ms; plus 12 AS 532ULs ordered December 1998 for delivery from 2000; two to be built by Eurocopter and remainder subcontracted to RUAG Aerospace, which see), Togo (one), Turkey (30 AS 532ULs and 20 AS 532ALs in SAR configuration, including 28 assembled by TAI; first Turkish-built AS 532AL handed over 1 May 2000; deliveries to be completed by February 2003; first Turkish-built AS 532UL handed over 31 May 2000), Venezuela (six), Zaïre (one VIP). Competing for Taiwanese UH-1 and Greek UH-1AB 205 replacement programmes. Bristow Helicopters acquired 31 examples of 19-passenger AS 332L for offshore oil support. AZAL of Azerbaijan ordered 22 AS 332L1s in 2003.

DESIGN FEATURES: Four-blade fully articulated main rotor turning clockwise seen from above; five-blade tail rotor on starboard side of tailboom; engines mounted above cabin have rear drive into main transmission at 23,840 rpm; main rotor turns at 265 rpm, tail rotor at 1,278 rpm; various lateral sponsons available housing partly retracted main landing gear and combinations of additional fuel or pop-out floats; optional air conditioning system housed in casing on port forward flank of cabin; all civil versions certified for IFR category A and B to FAR Pt 29.

FLYING CONTROLS: Dual fully powered hydraulic controls with full-time autostabilisation and yaw damping; machine remains flyable with autostabiliser switched off; cyclic trimming by stick friction adjustment; inverted slot on tailplane to maintain attitude-holding effect at low climb speeds; large ventral fin; saucer fairing on rotor head to smooth wake of hub; four-axis SFIM 155 autopilot standard.

STRUCTURE: Conventional light alloy airframe with some titanium; crashworthy fuel system, impact-absorbing landing gear and other features; main rotor blades of GFRP with CFRP stiffening and Moltoprene filler; elastomeric drag dampers.

LANDING GEAR: Retractable tricycle high energy absorbing design by Messier-Bugatti; all units retract rearward hydraulically, mainwheels into sponsons on sides of fuselage; dual-chamber oleo-pneumatic shock-absorbers; twin-wheel self-centring nose unit, tyre size 7.00-6 (8 ply) tubeless, pressure 7.00 bar (102 lb/sq in); single wheel on each main unit with tyre size 615x225-10 (12 ply) tubeless or 640x230-10, pressure 9.00 bar (130 lb/sq in);

hydraulic differential disc brakes, controlled by foot pedals; lever-operated parking brake; emergency pop-out flotation units can be mounted on main landing gear fairings and forward fuselage.

POWER PLANT: Two Turbomeca Makila 1A1 turboshafts, each with maximum contingency rating of 1,400 kW (1,877 shp) and take-off rating of 1,357 kW (1,820 shp). Maximum continuous rating of 1,184 kW (1,588 shp). Air intakes protected by a grille against ingestion of ice, snow and foreign objects; Centrisep multipurpose intake optional for flight into sandy areas. Transmission rated at 2,238 kW (3,000 shp) for T-O.

AS 532UC/AC have five flexible fuel tanks under cabin floor, with total usable capacity of 1,497 litres (395 US gallons; 329 Imp gallons); AS 532SC has total basic capacity of 2,141 litres (565 US gallons; 471 Imp gallons); AS 332L1/532UE/532UL/532AL have a basic fuel system of six flexible tanks with total capacity of 2,020 litres (533 US gallons; 444 Imp gallons) in the 332 and 2,003 litres (529 US gallons; 440 Imp gallons) in the 532; provision for additional 2,375 litres (627 US gallons; 522 Imp gallons) in five auxiliary ferry tanks installed in cabin; two external auxiliary tanks with total capacity of 636 litres (168 US gallons; 140 Imp gallons) standard on AS 532SC, optional on other versions; AS 532UB Cougar 100 has capacity of 1,533 litres (405 US gallons; 337 Imp gallons). For long-range missions (mainly offshore) in AS 332L1, a special internal auxiliary tank can be fitted in cargo sling well, in addition to the two external tanks, to raise total usable fuel capacity to 2,977 litres (786 US gallons; 655 Imp gallons). Refuelling point on starboard side of cabin; fuel system designed to avoid leakage following a crash; self-sealing tanks standard on military versions, optional on other versions; other options include a fuel dumping system and pressure refuelling.

ACCOMMODATION: One pilot (VFR) or two pilots side by side (IFR) on flight deck, with jump seat for third crew member or paratroop dispatcher; provision for composite light alloy/Kevlar armour for crew protection on military models; door on each side of flight deck and internal doorway connecting flight deck to cabin; dual controls, co-pilot instrumentation and crashworthy flight deck and cabin floors; maximum accommodation for 21 troops in AS 532UC, 20 passengers in AS 332L1 and 25 troops in AS 532UL, 20 troops in AS 532UE; interiors available for VIP, air ambulance with six stretchers and 11 seated casualties/attendants; strengthened floor for cargo carrying, with lashing points; jettisonable sliding door on each side of main cabin or port side door with built-in steps and starboard side double door in VIP configuration; removable panel on underside of fuselage, at rear of main cabin, for longer loads; removable door with integral steps for access to baggage racks optional; hatch in floor below main rotor contains hook for slung loads up to 4,500 kg (9,920 lb) on internally mounted cargo sling; cabin and flight deck heated, ventilated and soundproofed; demisting, de-icing, washers and wipers for pilots' windscreens.

SYSTEMS: Two independent hydraulic systems, supplied by self-regulating pumps driven by main gearbox. Each system supplies one set of powered flying controls: left-hand system also supplies autopilot, landing gear, rotor brake and wheel brakes; hydraulically actuated systems can be operated on ground from main gearbox (when a special disconnect system is installed to permit running of port engine with rotors stationary), or by external power through ground power receptacle. Emergency landing gear lowering by standby pump.

Three-phase 200 V AC electrical power supplied by two 20 kVA 400 Hz alternators, driven by port side intermediate shaft from main gearbox and available on ground under same conditions as hydraulic ancillary systems; two 28.5 V DC transformer-rectifiers; main battery used for self-starting and emergency power in flight.

AVIONICS: *Comms:* Optional equipment includes VHF, UHF, tactical HF and HF/SSB radio and intercom.

Radar: Offshore models have nose-mounted radar; search and rescue version has nose-mounted RDR 1400 or chin-mounted 1500 search radar (as on Swedish Hkp 10s); naval ASW and ASV versions can have nose-mounted Thales Ocean Master radar, linked to a tactical table in the cabin.

Flight: ADF, VOR/ILS, radio altimeter, GPS, VLF Omega, Decca navigator and flight log, Doppler, SFIM 155 autopilot, with provision for coupling to self-contained navigation and landing systems; search and rescue version has Doppler, and Thales Nadir or Decca self-contained navigation system (Nadir Mk 2 in French Army and Greek versions), including navigation computer with SAR patterns, polar indicator, roller map display, hover indicator, route mileage indicator and groundspeed and drift indicator; SFIM CDV 155 autopilot coupler contains automatic nav track including search patterns, transitions and hover; multifunction video display shows radar and route images, SAR patterns and hover indication; Swedish Hkp 10s have Thales RAMS flight management system including BAE Systems AHRs, Decca Doppler and GPS. Optional Honeywell Mk XXII EGPWS and HP899 TCAS.

Instrumentation: Full IFR instrumentation optional.

Mission: Naval ASW versions have Thomson Marconi HS 312 acoustics suite; upgraded FLASH version currently available.

EQUIPMENT: Optional fixed rescue hoist (capacity 275 kg; 606 lb) starboard side and electrical back-up hoist; equipment for naval missions can include sonar, MAD and sonobuoys.

ARMAMENT (optional): Typical alternatives for army/air force missions are two 20 mm guns or two 7.62 mm machine guns or two 68 mm rocket launchers. Armament for naval missions includes two AM 39 Exocet missiles or two lightweight torpedoes.

DIMENSIONS, EXTERNAL:

Main rotor diameter 15.60 m (51 ft 2 1/4 in)
Tail rotor diameter 3.05 m (10 ft 0 in)
Main rotor blade chord 0.60 m (1 ft 11 1/2 in)

Length: overall, rotors turning	18.70 m (61 ft 4 1/4 in)
fuselage, incl tail rotor:	
AS 532UC/AC/SC/UB	15.53 m (50 ft 11 1/2 in)
AS 332L1/532AL/UL/UE	16.29 m (53 ft 5 1/2 in)
tail and rotors folded (AS 532SC)	12.95 m (42 ft 5 3/4 in)
Width, blades folded:	
AS 532UB/UC/AC/AL/UL/332L1	3.79 m (12 ft 5 1/4 in)
AS 532SC	3.86 m (13 ft 3 in)
Width over sponsons:	
AS 332L1/AS 532AL/UL/UC/AC	3.38 m (11 ft 1 in)
AS 532SC	3.56 m (11 ft 8 1/4 in)
Fuselage max width	2.00 m (6 ft 6 in)
Height: overall	4.92 m (16 ft 1 3/4 in)
blades and tail pylon folded:	
AS 532UE/UC/AC/SC	4.80 m (15 ft 9 in)
to top of rotor head	4.60 m (15 ft 1 in)
Tailplane half-span	2.11 m (6 ft 11 in)
Wheel track	3.00 m (9 ft 10 in)
Wheelbase: AS 532UC/AC/SC	4.49 m (14 ft 8 3/4 in)
AS 332L1/532AL/UL/UE	5.25 m (17 ft 2 3/4 in)
Passenger cabin doors, each: Height	1.35 m (4 ft 5 in)
Width	1.30 m (4 ft 3 1/4 in)
Floor hatch, rear of cabin: Length	0.98 m (3 ft 2 3/4 in)
Width	0.70 m (2 ft 3 1/2 in)
DIMENSIONS, INTERNAL:	
Cabin:	
Length: AS 532UC/AC/SC	6.05 m (19 ft 10 1/2 in)
AS 332L1/532AL/UL/UE	6.81 m (22 ft 4 in)
Max width	1.80 m (5 ft 10 3/4 in)
Max height	1.55 m (5 ft 1 in)
Floor area: AS 532UC/AC/SC	7.80 m ² (84.0 sq ft)
AS 332L1/532AL/UL/UE	9.18 m ² (98.8 sq ft)
Usable volume:	
AS 532UC/AC/SC	11.4 m ³ (403 cu ft)
AS 332L1/532AL/UL/UE	13.3 m ³ (470 cu ft)
AREAS:	
Main rotor disc	191.13 m ² (2,057.3 sq ft)
Tail rotor disc	7.31 m ² (78.64 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty (standard aircraft):	
AS 532UC/AC	4,330 kg (9,546 lb)
AS 532SC	4,500 kg (9,920 lb)
AS 332L1/532AL/UL	4,460 kg (9,832 lb)
AS 332UE	4,485 kg (9,888 lb)
Max external payload	4,500 kg (9,920 lb)
Max T-O weight:	
internal load:	
AS 532UC/AC/AL/UB/UL/SC/UB/UE	9,000 kg (19,841 lb)
AS 332L1	8,600 kg (18,960 lb)
external slung load	9,350 kg (20,615 lb)
Max disc loading, external load	48.9 kg/m ² (10.02 lb/sq ft)
Transmission loading at max T-O weight and power:	
internal load:	
AS 532UC/AC/AL/UB/UL/SC/UE	4.03 kg/kW (6.61 lb/shp)
AS 332L1	3.85 kg/kW (6.32 lb/shp)
external load	4.18 kg/kW (6.87 lb/shp)
PERFORMANCE:	
Never-exceed speed (VNE)	150 kt (278 km/h; 172 mph)
Cruising speed at S/L:	
AS 532UC/AC/AL/UL/SC	139 kt (257 km/h; 160 mph)
AS 532UB/UE	134 kt (249 km/h; 155 mph)
AS 332L1	141 kt (261 km/h; 162 mph)
Max rate of climb at S/L:	
AS 532UC/AC/AL/UL	420 m (1,378 ft)/min
AS 532UB/UE	432 m (1,417 ft)/min
AS 532SC	372 m (1,220 ft)/min
AS 332L1	486 m (1,594 ft)/min
Service ceiling: AS 332L1	4,600 m (15,080 ft)
AS 532UC/AC/SC/AL/UL/UB/UE	4,100 m (13,450 ft)
Hovering ceiling IGE:	
AS 532AL/UL/AC/UC/SC/UB/UE	2,800 m (9,180 ft)
AS 332L1	3,250 m (10,660 ft)
Hovering ceiling OGE:	
AS 532AL/UL/AC/UC/SC/UB/UE	1,650 m (5,420 ft)
AS 332L1	2,300 m (7,540 ft)
Range at S/L, standard tanks, no reserves:	
AS 332L1	449 n miles (831 km; 516 miles)
AS 532UC/AC	334 n miles (618 km; 384 miles)
AS 532UB	309 n miles (573 km; 356 miles)
AS 532SC	492 n miles (911 km; 566 miles)
AS 532AL/UL	455 n miles (842 km; 523 miles)
AS 332L1	470 n miles (870 km; 540 miles)
AS 532UE	416 n miles (770 km; 478 miles)
Range with auxiliary internal tank:	
AS 532UE	486 n miles (900 km; 559 miles)
AS 532UB	380 n miles (703 km; 437 miles)
Range at S/L with external (two 338 litre) and auxiliary (one 320 litre) tanks, no reserves:	
AS 332L1	659 n miles (1,220 km; 758 miles)
AS 532UC/AC	528 n miles (977 km; 607 miles)
AS 532AL/UL	637 n miles (1,179 km; 733 miles)

EUROCOPTER SUPER PUMA Mk II, COUGAR Mk II, EC 225 and EC 725

Spanish Army designations: HU.21L

TYPE: Multirole medium helicopter.

PROGRAMME: Derived from Super Puma/Cougar Mk I (which see); first flight of development vehicle 6 February 1987; French certification 2 April 1992; UK BCAR 29 certification 16 November 1992; first delivery August 1993. Earlier AS 332L1 and 532U/A Cougar Mk I remain on production line.



Eurocopter EC 725 of French Air Force (Patrick Penna)

1040537

CURRENT VERSIONS: **AS 332L2 Super Puma Mk II:** Current production civil transport; innovations include Spheriflex rotor heads, super-emergency engine rating, EFIS flight deck and built-in health and usage monitoring system, duplex four-axis AFCS, and hydraulically powered standby electrics for 2 hours' operation after complete main generator failure. First delivery 28 August 1993.

AS 332L2 Super Puma Mk II VIP: Eight- to 15-passenger arrangement with attendant and fully equipped galley and lavatory; two four-seat lounges; fine materials and fittings throughout; range with eight passengers and attendant, 635 n miles (1,176 km; 730 miles).

AS 332L2 Super Puma Mk II 'Jigsaw': 'Project Jigsaw' launched by Bristow Helicopters in 2001, under contract to BP, to modify Super Puma G-JSAR for offshore SAR. Modifications include 'glass cockpit' and four-axis coupled autopilot for IFR/day/night approaches, search patterns, transitions and hover; additional radios (HF, VHF/FM Marine Band and UHF); Chelton Homer and Becker Homer; NightSun searchlight (30 million cd); Sky Shout loudspeaker; Iridium satellite telephone; AS-1 chin turret with FLIR; rescue hoist; and extensive medical equipment. Completed aircraft exhibited at Helitec, Duxford, UK, 23 to 25 September 2003.

AS 532U2 Cougar Mk II: Unarmed military tactical transport; longest member of Cougar family; carries 29 troops and two-man crew.

AS 532A2 Cougar Mk II: Armed version. First order (for four) by French Air Force for combat SAR, 1995; known as Cougar RESCO (REcherche et Sauvetage en Combat); prototype (F-ZVMC) undertook maker's trials in 1998; was delivered to CEAM military test unit on 9 September 1999 for one year of evaluation; second aircraft, to determine operational fit, was due to be delivered in 2000. Potential equipment includes RWR, missile approach warner, chaff, flares, rescue hoist, two outboard 20 mm cannon, two door-mounted 12.7 mm machine guns, encrypted Personnel Locator System, third-generation NVG-compatible lighting, air-to-air refuelling capability, Nadir Mk 2 navigation computer, SFIM PA-165 four-axis digital autopilot, VOR, Tacan, DME, GPS, searchlight and FLIR. Alternative maximum T-O weight of 11,200 kg (24,692 lb) permits an 800 n mile (1,482 km; 920 mile), plus 30 min hover and 30 min reserve, unrefuelled radius of action to rescue two persons.

EC 225 Super Puma Mk II+: Growth version, announced June 1998, as competitor to Sikorsky S-92 in offshore support role; has military counterpart in **EC 725 Cougar Mk II+**. Cabin volume increased by 25 per cent to 20.0 m³ (706 cu ft) through increases of 35 cm (13 3/4 in) in height, 70 cm (2 ft 3 1/2 in) in length and 25 cm (9 3/4 in) in width. Reinforced gearbox and 3,233 kW (2,411 shp) Makila 2A engines with FADEC produce 14 per cent power increase over earlier versions. Five-blade main rotor blades have composites spars and parabolic tips, diameter unchanged. MTOW increased to 10,400 kg (21,560 lb) for civil and 11,000 kg (24,251 lb) for military version (11,200 kg; 24,691 lb with external load). Max cruising speed 141 kt (261 km/h; 162 mph); range with central auxiliary fuel tanks 443 n miles (820 km; 510 miles). New integrated flight and display system (IFDS) using four 152 x 203 mm (6 x 8 in) multifunction LCDs plus four-axis autopilot. FAR/JAR-29 certification achieved July 2004 and first deliveries to French Air Force, December 2004; first customer delivery effected 22 December 2004 when Algerian Government received initial production EC 225 for its VIP transport unit. First prototype (No. 2338, F-ZVLR, converted from standard Mk II) made maiden flight 27 November 2000, at which time Eurocopter revealed an order for four from the French Air Force, including one earlier Mk 2 raised to this standard. JAR 29 certification expected by end 2003. Launch customer for EC 225 is CHC Helicopter, which ordered one (plus one AS332L2) in early 2001. French Air Force took delivery of initial aircraft 15 January 2001 for trials. First pre-production EC 725 (with Makila 1A4 engines) flew in September 2002. First fully equipped production example delivered December 2004 to EH1/67 'Pyrenées' at Cazaux, followed by three in 2005. Service entry eventually achieved on 10 May 2006 when four of six on order declared operational. Further order for 10 EC 725s for French special operations announced in late November 2002, with deliveries to be complete by end of 2006; these comprised two for Air Force (completing six required) and eight for Army special forces' support. Bristow Helicopters ordered two EC 225s, plus two options, on 12 January 2004. First production EC 225 flew 24 June 2004. EASA certification for flight into known icing conditions achieved in August 2005.

CUSTOMERS: By December 2004, total of 682 of Super Puma/Cougar family had been ordered, including 22 EC 225/725s. Combined sales of Super Puma/Cougar/EC 225/EC 725 totalled 15 in 2004 and 14 in 2005.

Production combined with Super Puma Mk I. Helicopter Service ordered four AS 332L2 Mk II in May 1992 and a further four in June 1997, latter delivered from 27 May 1998 onwards; RNethAF ordered 17 AS 532U2s October 1993 and deliveries began 1 April 1996 (with 400th AS 332/532) and last was received in October 1997; first of follow-on order for two for Bond Helicopters delivered 27 August 1998. Eventual 14 AS 532A2s required for combat SAR by French Air Force, first of four ordered delivered 9 September 1999; remainder to be delivered in three batches by 2015; these orders converted to EC 725 version late 2000. Saudi Arabia ordered 12 AS 532A2s in July 1996 under 'Al Fahd' contract for combat SAR, deliveries beginning in 1998; in-flight refuelling tests successfully completed during second half of 2000. VIP orders include Samsung (one AS 332L2), the German government (three AS 532U2s delivered from 4 November 1997 and operated by the Luftwaffe), and two AS 532L2s for Turkmenistan delivered in VVIP configuration in 2002. Three ordered for SAR by Hong Kong Government Flying Service for delivery mid-2001, the first being handed over 18 June 2001. Bond Offshore Helicopters Ltd of Aberdeen, Scotland, ordered six AS 332L2s on 10 December 2002, of which the first was delivered 19 May 2004. Recent customers include the Defence Agency of Japan, which



Eurocopter EC 225 operating in North Sea (Gérard Deulin)

1040542



Instrument panel of French Air Force EC 725

1040538

ordered in March 2005 for Imperial and VIP transport duties; the Japanese Coast Guard (two EC 225 for SAR duties); and CHC Helicopters, which ordered two in December 2005 for North Sea oil operations.

DESIGN FEATURES: Generally as for Mk I, but gross weight increased by 150 kg (331 lb) in 1993; composites plug in rear cabin area accommodates one extra row of seats and moves tail rotor rearwards; Spheriflex main and tail rotor heads with elastomeric spherical bearings and Kevlar retention bands; main rotor with longer blades having parabolic tips; enlarged composites sponsons can contain fuel, liferafts, air conditioning and pop-out floats.

FLYING CONTROLS: Fully powered hydraulically actuated with SFIM 165 four-axis digital AFCS and coupler.

STRUCTURE: Rear fuselage 55 cm (1 ft 9½ in) plug made of composites giving extra row of seats; large windows at rear of cabin; increased use of composites compared with Mk I; fuselage frames strengthened to retain same degree of crashworthiness.

LANDING GEAR: As Super Puma Mk I.

POWER PLANT: Two Turbomeca Makila 1A2 rear drive free turbines; maximum emergency power each (OEI 30 seconds) 1,573 kW (2,109 shp), 12 per cent higher than AS 332 Mk I; intermediate emergency power (OEI 2 minutes) 1,467 kW (1,967 shp); take-off power 1,376 kW (1,845 shp); maximum continuous power 1,236 kW (1,657 shp); protective intake grilles standard; optional Centrisep multipurpose intakes for dusty conditions. Transmission ratings: twin-engined maximum 2,410 kW (3,229 shp), maximum from single engine 1,666 kW (2,232 shp), maximum transient 20 seconds 2,651 kW (3,552 shp), maximum continuous 1,555 kW (2,084 shp); transmission has extended run-dry capability.

Standard fuel tankage under cabin floor 2,020 litres (535 US gallons; 444 Imp gallons); auxiliary tankage includes 324 litres (85.6 US gallons; 71.3 Imp gallons) in cargo hook well; sponson tanks each holding 325 litres (85.9 US gallons; 71.5 Imp gallons); 600 litres (159 US gallons; 132 Imp gallons) in cabin fuel tank; one to five internal ferry tanks each holding 475 litres (126 US gallons; 104.5 Imp gallons). Tankage (self-sealing tanks standard from 1997) AS 532A2 1,896 litres (500 US gallons; 417 Imp gallons); hook well tank 320 litres (84.5 US gallons; 70.4 Imp gallons); 325 litres (85.9 US gallons; 71.5 Imp gallons) in each sponson tank; crashproofing is standard in AS 532 and optional in 332; pressure refuelling optional. Military versions can be fitted with probe for in-flight refuelling.

ACCOMMODATION: Single pilot in DGAC Category B civil operation; single pilot plus licensed crewman in Category A VFR; two pilots in IFR; military operation one pilot in VFR, two in IFR; civil transport 24 passengers and attendant in airline interior for 220 n miles (408 km; 253 miles) or 19 passengers at 81 cm (32 in) seat pitch for 350 n miles (648 km; 403 miles); military capacity, squad chief plus 28 troops; SAR version four crew plus 15 survivors over radius of 285 n miles (527 km; 328 miles), VIP version for eight to 15 passengers plus attendant; ambulance version holds 12 stretchers and four seated casualties plus attendant.

AVIONICS: *Instrumentation:* Civil and military cockpits have Sextant Avionique four-tube EFIS integrated flight and display system (IFDS) with four 15 × 15 cm (6 × 6 in) screens; subsystems include smart multimode display (SMDS), automatic flight control system (AFCS) and flight data system (FDS); military cockpit compatible with night vision goggles; civil and military IFR system offered, plus military communications radio; SAR system includes radar and FLIR coupled to display system as well as navigation computer with Doppler and GPS sensors; can also be fitted with inertial nav sensor for combat SAR configuration at customer's request; SAR system can include automatic search pattern, transition and hover hold.

Flight: Optional Bendix/King Mark XXII EGIPWS.

Radar: RNethAF AS 532U2s have been retrofitted with Honeywell weather radar.

EQUIPMENT: Pop-out floats, rescue winch (272 kg; 600 lb), external sling. Military equipment (U2/A2) includes IR suppressors, flare/chaff dispensers, RWR, MAWS and armoured protection for crew and troops.

ARMAMENT: Armament choice as for AS 532A Cougar Mk I except for Exocet. Special sliding doors on forward cabin windows allow forward firing 7.62 mm machine guns to be fitted.

DIMENSIONS, EXTERNAL:

Main rotor diameter	16.20 m (53 ft 1½ in)
Tail rotor diameter	3.15 m (10 ft 4 in)
Length overall: rotors turning	19.50 m (63 ft 11 in)
main rotor folded	16.79 m (55 ft 0½ in)
Width: fuselage	2.00 m (6 ft 6 in)
over sponsons	3.38 m (11 ft 1 in)
overall, main rotor folded	3.86 m (12 ft 8 in)
Height: overall, tail rotor turning	4.97 m (16 ft 4 in)
to top of rotor head	4.60 m (15 ft 1 in)
Tailplane span	2.12 m (6 ft 11½ in)
Wheel track	3.00 m (9 ft 10 in)
Wheelbase	5.25 m (17 ft 2¾ in)
Sliding cabin doors, each: Height	1.35 m (4 ft 5 in)
Width	1.30 m (4 ft 3¼ in)
Floor hatch: Length	0.98 m (3 ft 2¾ in)
Width	0.70 m (2 ft 3¼ in)

DIMENSIONS, INTERNAL:

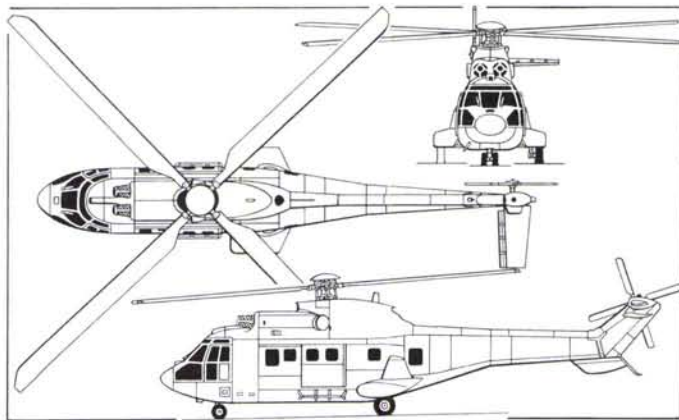
Cabin: Max length	7.87 m (25 ft 10 in)
Floor length	6.15 m (20 ft 2¼ in)
Max width	1.80 m (5 ft 10¾ in)
Max height	1.45 m (4 ft 9 in)
Volume	15.0 m³ (530 cu ft)

AREAS:

Main rotor disc	206.12 m² (2,218.7 sq ft)
Tail rotor disc	7.79 m² (83.88 sq ft)

WEIGHTS AND LOADINGS:

Manufacturer's weight empty: L2	4,686 kg (10,331 lb)
U2	4,945 kg (10,902 lb)
A2	5,012 kg (11,050 lb)
Useful load: L2	4,595 kg (10,130 lb)
U2	4,805 kg (10,593 lb)
A2	4,738 kg (10,445 lb)
EC 225	5,380 kg (11,861 lb)
EC 725	5,670 kg (12,500 lb)
Standard fuel weight: L2	1,596 kg (3,519 lb)
U2, crashworthy tanks	1,548 kg (3,412 lb)
Max normal T-O weight: L2	9,300 kg (20,502 lb)
U2	9,750 kg (21,495 lb)
EC 225, EC 725	11,000 kg (24,250 lb)
A2 Combat SAR	11,200 kg (24,692 lb)
Max slung load: A2/U2, EC 725	5,000 kg (11,023 lb)
L2	4,500 kg (9,920 lb)
Max flight weight with slung load:	
U2	10,500 kg (23,148 lb)
EC 225, EC 725	11,200 kg (24,692 lb)
Max disc loading, normal T-O weight:	
L2	45.1 kg/m² (9.24 lb/sq ft)
U2	47.3 kg/m² (9.69 lb/sq ft)
U2, alternate	54.3 kg/m² (11.13 lb/sq ft)



Eurocopter AS 332L2 Super Puma Mk II (Mike Keep)

1158934

Transmission loading at max T-O weight and power:	
L2	3.85 kg/kW (6.34 lb/shp)
U2 with slung load	4.35 kg/kW (7.16 lb/shp)
U2 alternate	4.65 kg/kW (7.64 lb/shp)
PERFORMANCE:	
Never-exceed speed (VNE):	
L2/U2/EC 725	170 kt (315 km/h; 195 mph)
Fast cruising speed: L2	
U2	150 kt (277 km/h; 172 mph)
U2	147 kt (273 km/h; 170 mph)
EC 225	156 kt (289 km/h; 180 mph)
EC 725	160 kt (296 km/h; 184 mph)
Econ cruising speed: L2	
U2	136 kt (252 km/h; 157 mph)
U2	132 kt (244 km/h; 152 mph)
Rate of climb at 70 kt (130 km/h; 81 mph) at S/L:	
L2	441 m (1,447 ft)/min
U2	384 m (1,260 ft)/min
Service ceiling (45.7 m; 150 ft/min climb), ISA:	
L2	5,180 m (17,000 ft)
U2	4,100 m (13,450 ft)
Hovering ceiling IGE, normal T-O weight, ISA, T-O power: L2	
U2	3,120 m (10,240 ft)
U2	2,690 m (8,820 ft)
Hovering ceiling OGE, normal T-O weight, ISA, T-O power: L2	
U2	2,250 m (7,380 ft)
U2	1,900 m (6,240 ft)
Hovering ceiling OGE, slung load weight, ISA, T-O power: L2/U2	
U2	960 m (3,150 ft)
Range, no reserves, standard fuel, econ cruise:	
L2	447 n miles (828 km; 514 miles)
U2	427 n miles (791 km; 491 miles)
Range, no reserves, max fuel, econ cruise:	
L2	656 n miles (1,215 km; 755 miles)
U2	636 n miles (1,178 km; 732 miles)
EC 225, EC 725	783 n miles (1,450 km; 901 miles)
Ferry range:	
EC 725	1,000 n miles (1,852 km; 1,150 miles)
Endurance, standard fuel, at 70 kt (130 km/h; 81 mph):	
L2	4 h 54 min
U2	4 h 20 min
EC 725	6 h 30 min

EUROCOPTER AS 350 ECUREUIL/ASTAR and AS 550 FENNEC
Brazilian Air Force designations: CH-50 and TH-5 Esquilo
Brazilian Army designation: HA-1 Esquilo
Brazilian Navy designation: UH-12 Esquilo
UK forces designation: Squirrel HT. Mk 1 and HT. Mk 2
TYPE: Light utility helicopter.
PROGRAMME: First flight (F-WVKH) powered by Lycoming LTS101 turboshaft 27 June 1974; first flight second prototype (F-WVKI) powered by Turbomeca Arriel 1A February 1975; first production version was AS 350B powered by 478 kW (641 shp) Arriel 1B and certified 27 October 1977; LTS101 powered AStar sold only in USA. AS 350BA Ecureuil was powered by 478 kW (641 shp) Turbomeca Arriel 1B and fitted with large main rotor blades of AS 350B2 (see below); maximum T-O weight increased by 150 kg (331 lb); AS 350B upgraded to AS 350BA in field; replaced AS 350B during 1992; French VFR certification 1991; UK and US certifications 1992, Japanese 1993. Production of AS 350BA ended in 1998.
Delivery of the 2,000th AS 350/550 (F-WWPZ, later ZJ270 of UK Defence Helicopter Flying School) effected in July 1997. In February 2001, delivery effected of 3,000th of Ecureuil family (including AS 355/555), which also was first EC 130 upgraded version. On 28 November 2005 the 3,000th of AS 350/550 single-engine variants was delivered to the South African Police Authority.
Built at Marignane, France, and under licence by Helibrás in Brazil (which see). See also the CHAIC Z-11 entry in the Chinese section. Federal Aviation Administration approval was granted 29 September 2005 for manufacture of the AS350B2/B3 at Eurocopter's facility in Columbus, Mississippi.
CURRENT VERSIONS: **AS 350B2 Ecureuil:** Up-rated engine and transmission; wide-chord new section main and tail rotor blades originally developed for AS 355 twin; certified 26 April 1989; known as **SuperStar** in North America; supplied to UK Ministry of Defence as **AS 350BB**, designated **Squirrel HT. Mk 1** with normal instrumentation and **Squirrel HT. Mk 2** with provision for pilot's NVGs.

AS 350B1, 350BA and 350B versions can be upgraded to 350B2.
AS 350B3 Ecureuil: Current variant; 632 kW (847 shp) Arriel 2B and wide-chord tail rotor; optimised for high-altitude operation; uprated transmission and digital engine control. First flight (F-WWPB) 4 March 1997; French VFR certification December 1997 after 150 hour test programme; first delivery, to Osterman Helicopter, January 1998; Australian and New Zealand certification achieved late 1998. By 1 June 2001, 180 AS 350B3s were in service with 120 customers, in 25 countries; 100th AS 350B3 delivered 14 December 1999 to Japanese customer and 400th on 18 December 2003 to Australian racing motorcyclist Mick Doohan.
AS 350D Astar: Version of 350B for North American market; improved LTS101 engine, with 6 per cent more power, offered early 1999.
AS 350 Firefighter: Conair system able to pick up water load in 30 seconds while hovering over water; demonstrated 1986; Isolair system certified September 1995.
AS 550A3 Fennec: Light attack version of AS 350B2 with 3-hour endurance; powered by 632 kW (847 shp), Arriel 2B; standard features include taller landing gear, sliding doors; NVG-compatible cockpit; reinforced airframe; provision for armoured seats and engine cowlings; can be armed with single 20 mm cannon or two rocket launchers.
EC 130: Described separately.

CUSTOMERS: Total 3,670 AS 350s, AS 355s and EC 130s ordered by at least 70 countries by June 2005, at which time combined flight time stood at more than 15 million flight hours.
Military customers include Singapore armed forces (10 AS 550B2 and 10 AS 550C2); Australia (RAAF 18 for training; RAN six utility); Danish Army (12 AS 550C2 with ESCO HelitOW system ordered 1987, delivered 1990); French Army ALAT (originally expressed need for up to 100 to replace Alouette IIs); French CEV (flight test centre), and FBS Ltd, which ordered 38 AS 350BBs, with deliveries beginning November 1996 and service entry in April 1997. Of these, 26 are Squirrel HT. Mk 1s with Defence Helicopter Flying School at Shawbury and 12 are NVG-compatible HT. Mk 2s with 670 Squadron, Army Air Corps, at Middle Wallop; by June 2001 the fleet had amassed 100,000 hours. Other orders include 11 for Brazilian Navy for liaison and patrol work; 30 for Brazilian Air Force for training; 36 for Brazilian Army (16 for liaison and 20 for training and firefighting); six AS 350B3 for Chilean Army; eight for China (see also CHAIC Z-11) and 40 AS 350B2 options for US Customs Service (augmenting five B2s delivered from 21 October 1998 to supplement 19 earlier AStars); six AS 550C3; 13 AS 350B3 ordered by United Arab Emirates in 2000; and four AS 350B3 for the South African Police Air Wing, of which last two delivered in January 2002. Recent customers include the Helicopter Transportation Group of Norway, which ordered five AS350B3s, plus five options, in June 2005, and Orange County Police of California, which took delivery of an AS350B2 at the HAI convention on 6 February 2005. Orders in 1997–2003 were 102, 73, 95, 137, 103, 132 and 81. Deliveries in 2003 were 122. Combined Ecureuil/Fennec/EC 130 orders in 2004 and 2005 totalled 146 and 193, respectively.
COSTS: AS 350B3 US\$1.4 million (2002).
DESIGN FEATURES: Conventional pod-and-boom design with power plant above cabin; fin, underfin and twin horizontal stabilising surfaces. Starflex bearingless glass fibre main rotor head; all versions now have lifting section composites main rotor blades. Main rotor turns at 394 rpm, tail rotor at 2,086 rpm.
FLYING CONTROLS: Single fully powered controls with accumulators to delay manual reversion following hydraulic failure until airspeed can be reduced; cyclic trim by adjustable stick friction; inverted aerofoil tailplane to adjust pitch attitude in climb, cruise and descent; saucer fairing on rotor head to smooth wake; swept fins above and below tail. Variety of autostabilisers and autopilots available (see Avionics).
STRUCTURE: Main rotor head of glass fibre and aramids; main rotor blades automatically manufactured in composites; self-sealing composites fuel tank in military versions.
LANDING GEAR: Steel tube skid type. Taller version standard on military aircraft. Emergency flotation gear optional.
POWER PLANT: AS 350B2 powered by one 546 kW (732 shp) Turbomeca Arriel 1D1 with transmission rated at 440 kW (590 shp) for T-O; AS 350B3/AS 550C3 powered by one 632 kW (847 shp) Turbomeca Arriel 2B turbine engine controlled by FADEC, with transmission rated at 500 kW (671 shp) for T-O; AS 350D powered by AlliedSignal LTS101 sold only in USA. Plastics fuel tank (self-sealing on AS 550) with capacity of 540 litres (143 US gallons; 119 Imp gallons). Optional 475 litre (125.5 US gallon; 104.5 Imp gallon) auxiliary tank in cabin.
Soloy offers conversion using Rolls-Royce 250-C30M turboshaft; see *Jane's Aircraft Upgrades*.
ACCOMMODATION: Two individual bucket seats at front of cabin and four-place rear bench standard, optional two-place front bench seat; optional ambulance layout; large forward-hinged door on each side of versions for civil use; optional sliding door at rear of cabin on



Against a flame-red background, Eurocopter AS 350B Ecureuil with appropriate registration F-HELL (Patrick Penna) 1040543

EUROCOPTER EC 130B

TYPE: Light utility helicopter.

PROGRAMME: Derived from AS 350B3 Ecureuil: PT-1 prototype first flew (unannounced) June 1999 and registered F-WQEV in May 2000; second prototype (F-WQES) assisted in 2000 hour test programme, including high-altitude testing in Albuquerque, USA, September 2000; JAA certification 14 December 2000; FAA certification 21 December 2000; revealed only in February 2001, when initial production aircraft (also 3,000th of Ecureuil family) handed over to Blue Hawaiian Helicopters at HeliExpo. Four preproduction helicopters delivered to launch customers in first half of 2001. 100th EC 130B (N130KL) delivered 25 November 2004 to Kendall-Jackson Wines Estates Ltd of Sonoma County, California.

CURRENT VERSIONS: **EC 130B4**: Initial production version.

CUSTOMERS: Announced orders include Blue Hawaiian (10 in 2001), Rocky Mountain Helicopters (10 in 2001), Mont Blanc Hélicoptères (two) and five to UK customers; deliveries started in June 2001 and totalled 10 in 2001, 30 in 2002 and 27 orders in 2003. Total 32 Dauphin/Panther/EC 155 ordered in 2004 and 25 in 2005. Recent customers include Helicoptersshuttle.com, which took delivery of one in April 2005 for executive transport and sightseeing tour operations in the Fort Lauderdale, Florida area.

COSTS: USD1.6 million (2002).

DESIGN FEATURES: As for AS 355B3, but considerably modified external appearance, with windscreen side panels, doors and landing gear from EC 120, plus Fenestron based on EC 135, although symmetrical, carried by redesigned tailboom. Dual hydraulic system from AS 355N. Cabin width increased by 25 cm (10 in) to give additional 23 per cent internal space, accommodating seven or eight seats and enlarged (10 per cent) baggage compartment; optional air conditioning. Retains AS 355B3 engine and transmission, but automatic system (in conjunction with dual-channel FADEC, plus third, digital, back-up channel) matches rotor speed to flight conditions for noise reduction; 84.3 EPNdB flyover rating is 7 dB below ICAO limit and 0.5 dB under special Grand Canyon National Park restrictions achieved by use of unequally spaced Fenestron blades.

LANDING GEAR: Emergency flotation system available. Tailskid. Handling wheels.

POWER PLANT: One 543 kW (728 shp) Turbomeca Arriel 2B1 turboshaft with transmission rated at 632 kW (847 shp) for T-O, with FADEC. Fuel capacity 540 litres (143 US gallons; 119 Imp gallons) in single tank.

ACCOMMODATION: Pilot and up to seven passengers in transport role; or pilot and one or two stretcher patients plus two medical attendants in casualty evacuation configuration. Dual controls.

SYSTEMS: 4.5 kW 28 V DC starter-generator, 15 Ah battery; 28 V DC cabin outlet.

AVIONICS: *Comms*: Shadin 8800 T altitude encoder; Garmin GTX327 Mode C transponder and Garmin GMA340 ICS.

Flight: One Bendix/King KX 165A nav/com/glideslope; Garmin GNS 430 GPS; Kannad 406 AF-H ELT; Thales H321EHM ADI; Bendix/King KI 525 HSI; full-colour VEMD (Vehicle and Engine Multifunction Display).

DIMENSIONS, EXTERNAL:

Main rotor diameter	10.69 m (35 ft 0 3/4 in)
Length: overall, rotors turning	12.64 m (41 ft 5 1/2 in)
fuselage	10.68 m (35 ft 0 1/2 in)
Fuselage max width	2.03 m (6 ft 8 in)
Height: to top of fin	3.61 m (11 ft 10 1/4 in)
to top of rotor head	3.34 m (10 ft 11 1/2 in)
Tailplane span	2.73 m (8 ft 11 1/2 in)
Skid track	2.31 m (7 ft 7 in)
Cabin door: Height	1.18 m (3 ft 10 1/2 in)
Max width: front	0.84 m (2 ft 9 in)
rear	0.92 m (3 ft 0 1/4 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.19 m (7 ft 2 1/4 in)
Max width	1.865 m (6 ft 1 1/2 in)
Max height	1.28 m (4 ft 2 1/2 in)
Volume	3.7 m ³ (131 cu ft)
Baggage hold volume:	
front, port	0.29 m ³ (10.2 cu ft)
front, starboard	0.25 m ³ (8.8 cu ft)
rear	0.57 m ³ (20.1 cu ft)

AREAS:

Main rotor disc	89.75 m ² (966.1 sq ft)
-----------------	------------------------------------

WEIGHTS AND LOADINGS:

Weight empty	1,379 kg (3,040 lb)
Max T-O weight: internal load	2,427 kg (5,351 lb)
external load	2,800 kg (6,173 lb)
Max disc loading:	
internal load	27.04 kg/m ² (5.48 lb/sq ft)



Eurocopter EC 130B4 (Patrick Penna)

1040555

port side; (sliding doors standard on military version); baggage compartment aft of cabin, with full-width upward-hinged door on starboard side; top of baggage compartment reinforced to provide work platform on each side.

SYSTEMS: Hydraulic system includes four single-body servo units, operating at 40 bar (570 lb/sq in) pressure, and accumulators to delay reversion to manual control; electrical system includes a 4.5 kW engine-driven starter/generator, a 24 V 15 Ah Ni/Cd battery and a ground power receptacle; cabin air conditioning system optional.

AVIONICS: *Comms*: VHF/AM radios, HF/SSB transponder and ICS.

Flight: VOR/ILS, ADF, marker beacon receiver and DME, SFIM PA 85T31 (IFR), GPS; full-colour LCD VEMD (vehicle and engine multifunction display) on AS 350B3 and AS 550C3.

EQUIPMENT: Options include 907 kg (2,000 lb) capacity cargo sling (1,160 kg; 2,557 lb for AS 350B2/550, 1,400 kg; 3,086 lb on AS 350B3), 136 kg (300 lb) capacity electric hoist (optional 204 kg; 450 lb on AS 350B3), a TV camera for aerial filming, SX-16 searchlight, Wescam and FLIR observation systems, and a 735 litre (194 US gallon; 161 Imp gallon) Simplex agricultural spraytank and boom system.

ARMAMENT (AS 550C3): Provision for wide range of weapons, including 20 mm Giat M621 gun, FN Herstal TMP twin 7.62 mm and 12.7 mm machine gun pods, Thomson Brandt 68.12 launchers for twelve 68 mm rockets, Forges de Zeebrugge launchers for seven 2.75 in rockets, and ESCO HeliTOW anti-tank missile system.

DIMENSIONS, EXTERNAL:

Main rotor diameter	10.69 m (35 ft 0 3/4 in)
Main rotor blade chord	0.35 m (13 3/4 in)
Tail rotor diameter	1.86 m (6 ft 1 1/4 in)
Tail rotor blade chord: AS 350D	0.185 m (7 1/4 in)
AS 350B2/B3/550C3	0.205 m (8 in)
Length: overall, rotors turning	12.94 m (42 ft 5 1/2 in)
fuselage	10.93 m (35 ft 10 1/2 in)
Width: fuselage (max)	1.87 m (6 ft 1 1/2 in)
overall, blades folded (horizontal stabiliser span)	2.53 m (8 ft 3 3/4 in)
Height overall: AS 350B2/B3/D	3.14 m (10 ft 3 1/2 in)
AS 550C3	3.34 m (10 ft 11 1/2 in)
Tailplane span	2.53 m (8 ft 3 1/2 in)
Skid track: AS 350B2/B3/D	2.17 m (7 ft 1 1/2 in)
AS 550C3	2.28 m (7 ft 5 1/4 in)
Cabin doors (civil versions, standard, each):	
Height	1.10 m (3 ft 7 1/4 in)
Width	0.80 m (2 ft 7 1/2 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.42 m (7 ft 11 1/4 in)
Width at rear	1.65 m (5 ft 5 in)
Height	1.30 m (4 ft 3 in)
Floor area	2.60 m ² (28.0 sq ft)
Baggage compartment volume	1.0 m ³ (35 cu ft)

AREAS:

Main rotor disc	89.75 m ² (966.1 sq ft)
Tail rotor disc	2.72 m ² (29.25 sq ft)

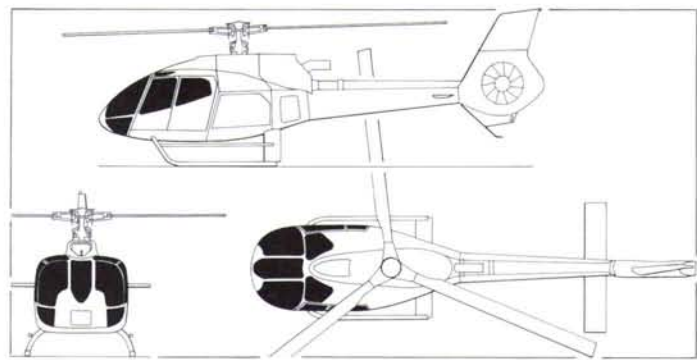
WEIGHTS AND LOADINGS:

Weight empty: AS 350B2	1,220 kg (2,690 lb)
AS 350B3	1,232 kg (2,917 lb)
AS 350D	1,123 kg (2,475 lb)
AS 550C3	1,220 kg (2,689 lb)
Max T-O weight:	
AS 350B2/B3/550C3	2,250 kg (4,960 lb)
AS 350D	1,950 kg (4,300 lb)
Max weight with slung load:	
AS 350B2	2,500 kg (5,511 lb)
AS 350B3/AS 550C3	2,800 kg (6,173 lb)
AS 350D	2,100 kg (4,630 lb)
Max disc loading:	
AS 350D with slung load	23.4 kg/m ² (4.79 lb/sq ft)
AS 350B2/550 clean	25.1 kg/m ² (5.13 lb/sq ft)
AS 350B2 with slung load	27.9 kg/m ² (5.71 lb/sq ft)
AS 350B3/550C3 with slung load	30.6 kg/m ² (6.28 lb/sq ft)
Transmission loading at max T-O weight and power:	
AS 350B2 clean	5.11 kg/kW (8.40 lb/shp)
AS 350B2 with slung load	5.68 kg/kW (9.34 lb/shp)
AS 350B3/550C3 clean	4.50 kg/kW (7.39 lb/shp)
AS 350B3/550C3 with slung load	5.50 kg/kW (9.04 lb/shp)

PERFORMANCE (AS 350D at normal T-O weight, AS 350B2/B3/550 at 2,200 kg; 4,850 lb):

Never-exceed speed (VNE) at S/L:	
AS 350B2/B3/550	155 kt (287 km/h; 178 mph)
AS 350D	147 kt (272 km/h; 169 mph)
Max cruising speed at S/L:	
AS 350B2	134 kt (248 km/h; 154 mph)
AS 350B3	140 kt (259 km/h; 161 mph)
AS 350D	124 kt (230 km/h; 143 mph)
AS 550C3	133 kt (246 km/h; 153 mph)
Max rate of climb at S/L:	
AS 350B2	534 m (1,752 ft)/min
AS 350B3/550C3	618 m (2,028 ft)/min
Service ceiling: AS 350B2	4,800 m (15,750 ft)
AS 350B3/550C3	5,280 m (17,323 ft)
Hovering ceiling:	
IGE: AS 350B2	3,200 m (10,500 ft)
AS 350B3/550C3	4,260 m (13,976 ft)
OGE: AS 350B2	2,550 m (8,360 ft)
AS 350B3/550C3	3,630 m (11,909 ft)
Range with max fuel at recommended cruising speed, no reserves:	
AS 350B2	362 n miles (670 km; 417 miles)
AS 350B3	352 n miles (652 km; 405 miles)
AS 550C3	346 n miles (641 km; 398 miles)

For details of the latest updates to *Jane's All the World's Aircraft* online and to discover the additional information available exclusively to online subscribers please visit jawa.janes.com



Eurocopter EC 130B (Turbomeca Arriel turboshaft) (Paul Jackson) 0062408

external load	31.20 kg/m ² (6.39 lb/sq ft)
Max power loading:	
internal load	4.47 kg/kW (7.35 lb/shp)
external load	5.16 kg/kW (8.48 lb/shp)
PERFORMANCE (two occupants):	
Never exceed speed (VNE)	155 kt (287 km/h; 178 mph)
Max operating speed	127 kt (235 km/h; 146 mph)
Max rate of climb at S/L	698 m (2,290 ft)/min
Service ceiling	7,010 m (23,000 ft)
Hovering ceiling: IGE	5,875 m (19,280 ft)
OGE	5,320 m (17,460 ft)
OPERATIONAL NOISE LEVELS (ICAO Annex 16 Ch 8):	
Average	86.8 EPNdB
Overflight	84.3 EPNdB

EUROCOPTER AS 355 ECUREUIL 2/TWINSTAR and AS 555 FENNEC

Brazilian Air Force designations: CH-55 and VH-55 Esquilo
Brazilian Navy designation: UH-12B Esquilo
Royal Air Force name: Twin Squirrel
TYPE: Light utility helicopter.
PROGRAMME: Twin-engined version of AS 350. First flight of first prototype (F-WZLA) 28 September 1979; details of early production AS 355E/F versions in 1984–85 *June*’s; AS 355F superseded by AS 355F1 in January 1984; AS 355F2 certified 10 December 1985; AS 355N powered by two Turbomeca TM 319 Arrius 1A certified in France in 1989, UK and USA in 1992; deliveries of this version began early 1992.

CURRENT VERSIONS: Current production AS 355 Ecureuil 2 and AS 555 Fennec are powered by two Turbomeca Arrius1A turboshafts.

AS 355N Ecureuil 2: Current civil production version, adaptable for passengers, cargo, police, ambulance, slung loads, carrying harbour pilots, working on high-tension cables and other missions; Category A OEI performance; known as **TwinStar** in USA.

Details refer to AS 355N, except where stated.

AS 555UN Fennec: Military utility version and French Army ALAT IFR pilot trainer.

AS 555AN Fennec: Armed version; later machines adapted for centreline-mounted 20 mm gun and pylon-mounted rockets.

AS 555MN Fennec: Naval unarmed version. Can carry a 360° chin-mounted radar.

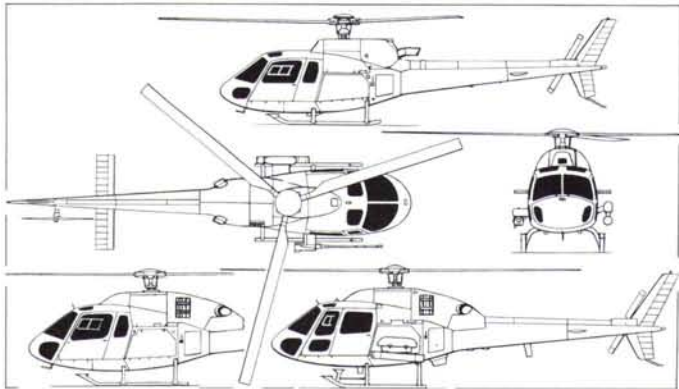
AS 555SN Fennec: Armed naval version for ASW and over-the-horizon targeting, operating from ships of 600 tonnes upwards; armament includes one lightweight homing torpedo or the cannon and rockets of land-based versions; avionics include Honeywell RDR-1500B 360° chin-mounted radar, Thales Nadir 10 navigation system, Thales RDN 85 Doppler and SFIM 85 T31 three-axis autopilot.

CUSTOMERS: Total 620 twin-engined Ecureuils in service at December 2003. French Air Force ordered 52 Fennecs, first eight as AS 355F1s powered by Rolls-Royce 250; flown by 67e Escadre d’Hélicoptères at Villacoublay and other units for communications and, with side-mounted Giat M61 20 mm gun pod, by ETOM 68 in Guyana; delivery of remaining 44 (AS 555AN powered by Arrius) began 19 January 1990; from 24th onwards, provision for centrally mounted 20 mm cannon and T-100 sight, plus Mistral missiles; French Army ordered 18 AS 555UNs for IFR training (delivery from February 1992); Brazilian Air Force has 13 AS 555s: 11 with armament, designated CH-55, and two VIP transports, designated



Eurocopter AS 355N Ecureuil in law-enforcement configuration (Gérard Deulin)

1040549



Eurocopter AS 555AN Fennec twin-turbine armed helicopter with side view (top) of single-engined AS 350B3 Ecureuil and scrap view (bottom) of AS 355N civil twin (Dennis Punnett) 1158933

VH-55: Brazilian Navy acquired 11 UH-12Bs; Brazilian AS 555s assembled by Helibrás in Brazil (which see); four more navies ordered eight AS 555s in 1992, two in 1993, four in 1994 and one in 1995. Two AS 355F1s, leased from OSS of Hayes, UK, supplied to the RAF’s No. 32 (The Royal) Squadron at Northolt on 1 April 1996 for VIP transport; third subsequently added. Total of six AS 555Ns ordered by Malaysian Navy on 13 October 2001 to replace Westland Wasps with deliveries at end 2003. Orders in 1997–2003 totalled nine, 20, 10, 13, 17, four and 17. Total of seven delivered in 2003. Combined Ecureuil/Fennec/EC 130 orders in 2004 and 2005 totalled 146 and 193, respectively.

DESIGN FEATURES: Starflex main rotor; two engine shafts drive into combiner gearbox containing freewheels; main rotor turns at 394 rpm and tail rotor at 2,086 rpm; otherwise substantially as AS 350.

FLYING CONTROLS: Powered, full dual flying controls without manual reversion; trim by adjustable stick friction; inverted aerofoil tailplane; swept fins above and below tailboom. STRUCTURE: Light metal tailboom and central fuselage structure; thermoformed plastics for cabin structure.

LANDING GEAR: As for AS 350B2/550.

POWER PLANT: Two Turbomeca Arrius 1A turboshafts, each rated at 357 kW (479 shp) for take-off and 302 kW (406 shp) maximum continuous; 388 kW (520 shp) 30 minutes OEI emergency; 407 kW (547 shp) 2.5 minutes OEI emergency; full authority digital engine control (FADEC) allows automatic sequenced starting of both engines, automatic top temperature and torque limiting and preselection of lower limits for practice OEI operation. Transmission rating 511 kW (686 shp) for T-O. Two integral fuel tanks, with total usable capacity of 730 litres (193 US gallons; 160 Imp gallons), in body structure. Optional 475 litre (126 US gallon; 105 Imp gallon) auxiliary tank in cabin.

ACCOMMODATION: As for single-engined Ecureuil and Fennec.

SYSTEMS: As for AS 350B2/550, except two hydraulic pumps, reservoirs and tandem powered flying control units and electric generators.



Malaysian Navy Eurocopter AS 555SN (Patrick Penna)

1040553

AVIONICS: Options include a second VHF/AM and radio altimeter; provision for IFR system. SFIM 85 T31 three-axis autopilot and CDV 85 T3 nav coupler.

EQUIPMENT: Casualty installations, TV, FLIR, searchlight and 204 kg (450 lb) capacity winch available. Cargo hook optional; capacity 1,134 kg (2,500 lb). See also Current Version descriptions.

ARMAMENT (AS 555): Optional alternative weapons include TDA or Forges de Zeebrugge rocket packs, Matra or FN Herstal machine gun pods or a Giat M621 20 mm gun. Naval version carries one homing torpedo in ASW role, or SAR winch.

DIMENSIONS, EXTERNAL: As for AS 350B2/550C3, except:

Width: fuselage	1.87 m (6 ft 1½ in)
overall, blades folded	3.05 m (10 ft 0 in)
Tailplane span	3.05 m (10 ft 0 in)

DIMENSIONS, INTERNAL: As for AS 350B2/550C3

WEIGHTS AND LOADINGS:

Weight empty	1,437 kg (3,168 lb)
Max sling load	1,134 kg (2,500 lb)
Max T-O weight: internal load	2,600 kg (5,732 lb)
max sling load	2,600 kg (5,732 lb)
Max disc loading: internal load	29.0 kg/m ² (5.93 lb/sq ft)
external load	29.0 kg/m ² (5.93 lb/sq ft)
Transmission loading at max T-O weight and power:	
internal load	5.09 kg/kW (8.36 lb/shp)
external load	5.09 kg/kW (8.36 lb/shp)

PERFORMANCE (ISA):

Never-exceed speed (VNE)	150 kt (278 km/h; 172 mph)
Max cruising speed at S/L:	
AS 355N	120 kt (222 km/h; 138 mph)
AS 555UN/AN/MN/SN	118 kt (219 km/h; 136 mph)
Econ cruising speed	117 kt (217 km/h; 135 mph)
Max rate of climb at S/L	384 m (1,260 ft)/min
Rate of climb at S/L, OEI	156 m (512 ft)/min
Service ceiling	3,800 m (12,460 ft)
Service ceiling, OEI	1,450 m (4,760 ft)
Hovering ceiling: IGE	2,000 m (6,560 ft)
OGI	750 m (2,460 ft)
Radius, SAR, two survivors	70 n miles (129 km; 80.5 miles)
Range with max fuel at S/L, no reserves:	
AS 355N	385 n miles (713 km; 443 miles)
AS 355UN/AN	386 n miles (714 km; 444 miles)
AS 355MN/SN	350 n miles (648 km; 402 miles)
Endurance, no reserves:	
one torpedo, or cannon or rocket pods	2 h 20 min
cannon plus rockets	1 h 50 min

EUROCOPTER AS 365N DAUPHIN 2 and AS 565 PANTHER

US Coast Guard designation: HH-65A Dolphin

Israel Defence Force name: Dolpheen

TYPE: Light utility helicopter.

PROGRAMME: Certified for VFR in France November 1989; 500th Dauphin (all versions) delivered in November 1991 was 83rd AS 365N2. Dauphin family had flown 2.86 million flying hours by June 2001.

CURRENT VERSIONS: **AS 365N2 Dauphin 2:** Recent baseline version; now produced in parallel with AS 365N3.

Details below refer to N2 version.

AS 365N3 Dauphin: Improved hot-and-high version; technology for N3 and N4 versions developed by experimental DGV (Dauphin Grande Vitesse) F-WDFK; DGAC certification in October 1997 and first delivery to Noordzee Helikopter Vlaanderen of Belgium in early 1998. Turbomeca Arriel 2C engines offer maximum T-O weight up to 48°C (118°F), rather than N2's 36°C (97°F). FADEC as standard. Orders had reached 40 by mid-2000. Upgrade of AS 365N1 and 365N2 is offered by Eurocopter.

AS 365N4 Dauphin: Redesignated EC 155; see following entry.

AS 366G1 (HH-65A Dolphin): US Coast Guard version (99 built, plus two ex-trials aircraft bought for evaluation by Israel as Dolpheen); trial installation of 895 kW (1,200 shp) LHTEC T800 turboshaft ordered February 1990, but abandoned November 1991 when LTS101 performance promised to improve; re-engining with French Arriels also declined. For description see 1991-92 and earlier *Jane's*.

AS 565UB Panther: Army version; last described in 2001-02 edition.

AS 565SB Panther: Naval version; last described in 2001-02 edition.

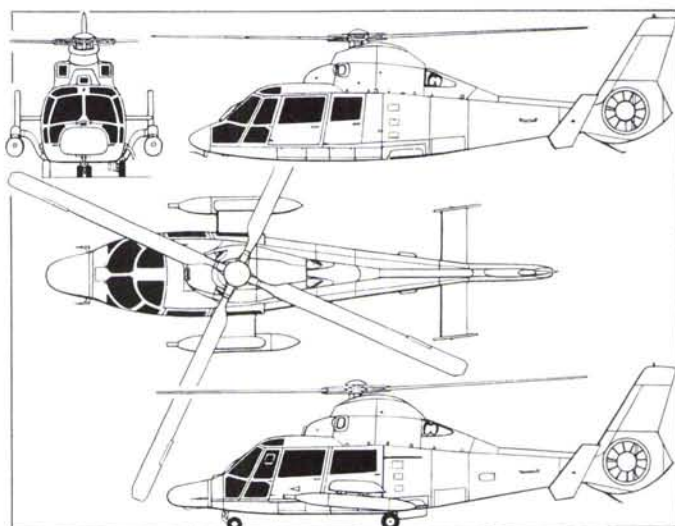
Ambulance/EMS: Flight crew of two plus two or four stretchers along cabin sides loaded through rear doors; up to four seats can replace stretchers on one side; doctor sits in middle with equipment; rear doors open through 180° instead of sliding.

Offshore support: Pilot plus up to 12 passengers, autopilot and navigation systems, pop-out floats.



French Navy Eurocopter AS 365F

1040554



Military Panthers: Eurocopter AS 565AA with side view (top) of AS 365N2 Dauphin 2 (Dennis Punnett)

1158932

DTV5: (*Démonstrateur Technologie Véhicule*) Demonstrator of new Dauphin variant; new rotor of 13.50 m (44 ft 3½ in) diameter; Tigre transmission; and two 809 kW (1,085 shp) Turbomeca TM 333-2E1 turboshafts. Conversion of Dauphin N4 prototype, subsequently renamed Dolphin VHS (very high speed).

Dolphin FWB: Testbed for fly-by-wire technology used in NH 90.

CUSTOMERS: Total 684 AS 365/366/565 ordered for civil and military use by over 187 customers from 53 countries by January 2001; 599 then in service; totals include 50 produced as Harbin Z-99A in China and 101 in HH-65A Dolphin US Coast Guard versions; Chinese production by HAMC (which see) continuing. Dauphin and Panther orders in 1998-2003 totalled 28, 18, 18, 10, seven and 27. Total 32 Dauphin/Panther/EC 155 ordered in 2004 and 25 in 2005. Eurocopter has entered offset agreement with LOT of Slovak Republic to allow modification of AS 365s for East European customers; first sale announced 1998. Recent customers include the Mexican Navy, which ordered two Panthers, plus eight options, in 2003, for delivery in 2005. Greece (six AS 365N3s), and the Bulgarian Ministry of Defence, which ordered six AS565MBs on 28 January 2005 for delivery to the Bulgarian Navy over a three-year period.

DESIGN FEATURES: Progressively tapered rear fuselage with stabilising surfaces comprising horizontal tail with endplate fins, plus central fin; Fenestron anti-torque rotor; engines above cabin.

AS 365N2 and N3 have Starflex main rotor hub with four blades; 11-blade Fenestron; main rotor blades have quick disconnect pins for manual folding; ONERA OA 212



Eurocopter AS 365N3 (Patrick Penna)

1040550

(thickness/chord ratio 12 per cent) at root to OA 207 (thickness/chord ratio 7 per cent) at tip; adjustment tab near tip; leading-edge of tip swept at 45°; main rotor rpm 350; Fenestron rpm 3,665; rotor brake standard. AS 365N3 can be retrospectively fitted with EC 155's five-blade Spheriflex main rotor and 10-blade Fenestron rotor with unevenly spaced blades to reduce vibration.

FLYING CONTROLS: Hydraulic dual fully powered; cyclic trim by adjustable stick friction damper; fixed tailplane, with endplate fins offset 10° to port; IFR systems available.

STRUCTURE: Mainly light alloy; machined frames fore and aft of transmission support; main rotor blades have CFRP spar and skins with Nomex honeycomb filling; Fenestron duct and fin of CFRP and Nomex/Rohacell sandwich; nose and power plant fairings of GFRP/Nomex sandwich; centre and rear fuselage assemblies, flight deck floor, roof, walls and bottom skin of fuel tank bays of light alloy/Nomex sandwich.

LANDING GEAR: Hydraulically retractable tricycle type; twin-wheel self-centring nose unit retracts rearward; single wheel on each main unit; main legs retract into troughs in fuselage without cover doors; all three units have oleo-pneumatic shock-absorber; mainwheel tyres 15x6.00-6 or 380x150-6 (6 ply) tubeless, pressure 8.60 bar (125 lb/sq in); nosewheel tyres size 13x5.00-4, pressure 5.50 bar (80 lb/sq in); hydraulic disc brakes.

POWER PLANT: AS 365N2: Two Turbomeca Arriel 1C2 turboshafts, each rated at 551 kW (739 shp) for T-O and 471 kW (631 shp) maximum continuous, mounted side by side aft of transmission with stainless steel firewall between them. Transmission rating 965 kW (1,294 shp) for T-O and maximum continuous.

AS 365N3: Two FADEC-equipped Turbomeca Arriel 2C turboshafts, each rated at 635 kW (851 shp) for T-O. 597 kW (800 shp) maximum continuous and 729 kW (977 shp) for 30 seconds.

Standard fuel in four tanks under cabin floor and fifth tank in bottom of centre-fuselage; total capacity 1,135 litres (300 US gallons; 249.5 Imp gallons); provision for auxiliary tank in baggage compartment, with capacity of 180 litres (47.5 US gallons; 39.5 Imp gallons); or ferry tank in place of rear seats in cabin, capacity 475 litres (125.5 US gallons; 104.5 Imp gallons); refuelling point above landing gear door on port side. Oil capacity 14 litres (3.7 US gallons; 3.1 Imp gallons).

ACCOMMODATION: Standard accommodation for pilot and co-pilot or passenger in front, and two rows of four seats to rear; high-density seating for one pilot and 12 passengers; VIP configurations for four to six persons in addition to pilot; three forward-opening doors on each side; freight hold aft of cabin rear bulkhead, with door on starboard side; cabin heated and ventilated.

SYSTEMS: Air conditioning system optional. Duplicated hydraulic system, pressure 60 bar (870 lb/sq in). Electrical system includes two 4.8 kW starter/generators, one 24 V 27 Ah battery and two 250 VA 115 V 400 Hz inverters.

AVIONICS: *Comms:* Optional transponder.

Radar: Optional weather radar.

Flight: SFIM 155 duplex autopilot; optional VOR, ILS, ADF, DME, GPS and SFIM CDV 85 autopilot coupler. Optional Bendix/King Mark XXII EGPWS.

Instrumentation: Two-pilot IFR instrument panel; optional EFIS.

EQUIPMENT: Includes 1,600 kg (3,525 lb) capacity cargo hook, and 275 kg (606 lb) capacity hoist with 90 m (295 ft) cable.

DIMENSIONS, EXTERNAL (N2 and N3):

Main rotor diameter	11.94 m (39 ft 2 in)
Fenestron diameter	1.10 m (3 ft 7¼ in)
Main rotor blade chord: basic	0.385 m (1 ft 3¼ in)
outboard of tab	0.405 m (1 ft 4 in)
Length: overall, rotor turning	13.73 m (45 ft 0½ in)
fuselage	11.63 m (38 ft 2 in)
Width, rotor blades folded	3.25 m (10 ft 8 in)
Height: to top of rotor head	3.47 m (11 ft 4½ in)
overall (tip of fin)	4.06 m (13 ft 4 in)
Wheel track	1.90 m (6 ft 2¾ in)
Wheelbase	3.64 m (11 ft 11¼ in)
Main cabin door (fwd, each side):	
Height	1.16 m (3 ft 9½ in)
Width	1.14 m (3 ft 9 in)
Main cabin door (rear, each side):	
Height	1.16 m (3 ft 9½ in)
Width	0.87 m (2 ft 10¼ in)

Baggage compartment door (stbd):	
Height	0.51 m (1 ft 8 in)
Width	0.73 m (2 ft 4¾ in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.30 m (7 ft 6½ in)
Max width	1.92 m (6 ft 3¾ in)
Max height	1.16 m (3 ft 9¾ in)
Floor area	4.20 m² (45.2 sq ft)
Volume	5.0 m³ (176 cu ft)
Baggage compartment volume	1.6 m³ (56 cu ft)

AREAS:

Main rotor disc	111.97 m² (1,205.2 sq ft)
Fenestron disc	0.95 m² (10.23 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: N2	2,281 kg (5,028 lb)
N3	2,302 kg (5,075 lb)
Max T-O weight: N2	4,250 kg (9,369 lb)
N3	4,300 kg (9,480 lb)
Max disc loading: N2	37.9 kg/m² (7.78 lb/sq ft)
N3	38.4 kg/m² (7.87 lb/sq ft)
Transmission loading at max T-O weight and power:	
N2	4.40 kg/kW (7.24 lb/shp)

PERFORMANCE:

Never-exceed speed (VNE):	
N2 and N3	155 kt (287 km/h; 178 mph)
Max cruising speed:	
N2 and N3	150 kt (278 km/h; 173 mph)
Econ cruising speed: N2	137 kt (254 km/h; 158 mph)
N3	148 kt (274 km/h; 170 mph)
Max rate of climb at S/L: N2	408 m (1,339 ft)/min
Rate of climb at S/L, OEI: N2	78 m (256 ft)/min
N3	183 m (602 ft)/min
Service ceiling: N2	3,700 m (12,140 ft)
N3	4,700 m (15,420 ft)
Service ceiling, OEI: N2	1,200 m (3,940 ft)
N3	1,870 m (6,140 ft)
Hovering ceiling:	
IGE: N2	2,000 m (6,560 ft)
N3	2,620 m (8,600 ft)
OGE: N2	1,200 m (3,940 ft)
N3	1,150 m (3,780 ft)
Max range with standard fuel:	
N2	464 n miles (859 km; 534 miles)
N3	440 n miles (815 km; 506 miles)
Endurance with standard fuel: N2	4 h 18 min
N3	4 h 6 min

EUROCOPTER EC 155B

TYPE: Light utility helicopter.

PROGRAMME: Programme launched September 1996, as further development of Dauphin 2. Announced at 1997 Paris Air Show, when known as AS 365N4 Dauphin 2. First flight 17 June 1997 as conversion of DGV testbed F-WDFK (see AS 365N Dauphin 2 entry); 1,000 flying hours achieved by February 1998. New, EC 155 designation revealed at HAI convention, February 1998. First production EC 155 (F-WWOZ) flew 11 March 1998. JAR certification received 9 December 1998. FAR certification was due late 1999. Certification for single pilot in IFR issued 25 January 2000.

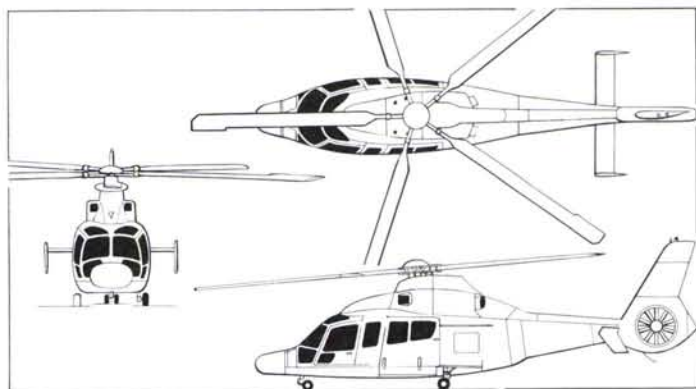
CURRENT VERSIONS: EC 155B: Baseline version; replaced in 2002; MTOW 4,800 kg (10,582 lb) and Arriel 2C1 engines.

EC 155B1: Upgraded version from 2002; as described. Features include new engine cowlings, new hydraulic cooling system, chip detectors, cargo fire protection, jettisonable cockpit doors; fixed cockpit footsteps and Thales AHV 16 radar altimeter display. Available



Eurocopter EC 155B (Patrick Penna)

1040551



Eurocopter EC 155B (James Goulding)

0130860

with standard Corporate, Offshore and Parapublic equipment packages. Increased MTOW of 4,920 kg (10,847 lb) approved at end of 2004.

EC 155B HTT: *Hélicoptère Tous Temps* (all-weather helicopter). Technology demonstrator (F-WQEZ), first flown 15 October 2002, for evaluation of helicopter navigation, ground collision avoidance and autopilot systems, aimed at relaxation of rules for rotary-wing IFR operations. Equipment includes a GPS/DGPS-based position-finding system which communicates with a ground station at Eurocopter's Marignane facility; four-axis autopilot, permitting steep approaches in zero visibility; and a mission computer with database-stored terrain maps which manages three-dimensional flight plans, coupled with ground collision avoidance system, to ensure safe terrain clearance during en route flight in zero visibility. Mission information is displayed on two large cockpit displays with three-dimensional mapping. Eurocopter expects that the technologies being evaluated in the HTT will be incorporated in its range of helicopters from 2005.

CUSTOMERS: Total of 63 delivered by January 2005, at which time total fleet time stood at 54,000 hours. Some 80 on order by mid-2006. Total of nine delivered in 2003. Total 32 Dauphin/Panther/EC 155 ordered in 2004 and 25 in 2005. First customer, German Border Guard (Bundesgrenzschutz; BGS), ordered 13 for delivery between 16 March 1999 and 2000 and further two in February 2002 for delivery in 2003. German Interior Ministry ordered two for Baden-Württemberg regional government in February 2000 for delivery in March 2001; Hong Kong Government Flying Service ordered five of which last delivered 17 December 2002; Shell Nigeria ordered six in 2000; first aircraft delivered on 26 September 2001. Swedish Helicopter Service ordered three in June 2001 for delivery between October and December 2002. Sales in 2001 including three for COHC (China), two for SFC (Vietnam) and three for SHS (Sweden). Further 13 purchased by BGS in February 2002. AZAL of Azerbaijan ordered four in 2003. Royal Thai Police ordered two on 6 February 2004, for delivery in VIP configuration by January 2005. Recent customers include Heli-Air Monaco/Monacair, which took delivery of one on 12 September 2005, and Bistow Helicopters which has selected the EC155 to support oil and gas platform crew change operations in the southern sectors of the north sea under a seven-year contract awarded by Shell Exploration and Production.

COSTS: Royal Thai Police order for two valued at USD25 million (2004).

DESIGN FEATURES: Compared to earlier Dauphin models, has bulged sliding cabin doors, redesigned cabin windows and 40 per cent larger cabin area. Five-blade Spheriflex main rotor and 10-blade Fenestron rotor with unevenly spaced blades to reduce noise.

FLYING CONTROLS: As AS 365N.

STRUCTURE: As AS 365N.

LANDING GEAR: As AS 365N.

POWER PLANT: Two FADEC-equipped Turbomeca Arriel 2C2 turboshafts, each rated at 697 kW (935 shp) for T-O. 645 kW (865 hp) max continuous power and 780 kW (1,046 shp) for 30 seconds. Standard fuel in six tanks, total capacity 1,257 litres (332 US gallons; 277 Imp gallons); provision for auxiliary tank in baggage compartment, with capacity for 180 litres (47.6 US gallons; 39.6 Imp gallons); or ferry tank in place of rear seats in cabin, capacity 460 litres (121.5 US gallons; 101 Imp gallons); refuelling point above landing gear door on port side. Oil capacity 14 litres (3.7 US gallons; 3.1 Imp gallons).

ACCOMMODATION: Standard accommodation for pilot and co-pilot or passenger in front, and three rows of four seats to rear; high-density seating for one pilot and up to 14 passengers; VIP configurations for between four and eight persons in addition to pilot; 12 cabin seats in offshore version; up to six stretchers in casevac role; one crew door and one large sliding door on each side; freight hold aft of cabin rear bulkhead, with door on both sides. Option of hinged cabin door on VIP versions.

SYSTEMS: Electrical system includes two starter/generators, each 160 A, 28 V DC and 43 Ah Ni/Cd battery. Duplicated hydraulic system. Optional 10 kVA alternator.

AVIONICS: *Corporate:* Twin Collins 422A VHF/AM; Collins TDR 94D transponder; NAT AA20-431 passenger address system; Team BA 1920 passenger interphone. *Kannad* 406AF ELT. *Optional Maritime* NPX 138, Collins HF 9100 HF/SSB and Collins TDR 94D transponder; Rascal CPT 609 ELT. *Offshore:* Twin Collins 422A; TRD 94D; NPX 138 standard; AA20-431; BA 1920; Kannad 406. *Optional second TDR 94D and CPT 609.* *Parapublic:* Twin Collins 422A; TDR 94D; AA20-431; BA 1920; Kannad 406. *Optional NPX 138, HF 9100, CPT 609.*

Radar: *Corporate:* Telephonics RDR 2000 with VRU. *Offshore:* Telephonics RDR 1400C standard; RDR 2000 optional replacement. *Parapublic:* RDR 1400C.

Flight: *Corporate:* Universal UNS-ID flight management system, Twin Collins VIR 432 VOR/ILS; Collins DME 442; Collins ADF 462. *Optional Honeywell CAS 66A TCAS.* *Euroavionics* Euronav 3 moving map, Rascal V 694 voice alerting system. *Offshore:* UNS-ID; Twin Collins VIR 432; DME 442; ADF 462. *Optional Trimble TNL 2101 (replacing UNS-ID).* *Bendix CAS 66A TCAS.* *Euronav 3, V 694.* *Parapublic:* UNS-ID; Twin VIR 432; DME 442; ADF 462. *Optional CAS 66A, Euronav 3, V 694.*

Instrumentation: As AS 365N, but optional eighth MFD available (152 × 203 mm; 6 × 8 in) for mission equipment display.

Mission: German Border Guard aircraft to have Hellas obstacle warning system.

EQUIPMENT: Standard role packages, included in equipped weight, comprise:

Corporate: Air conditioning, hinged cabin doors, fin and belly strobe lights, retractable passenger steps both sides, improved soundproofing and carpets.

Offshore: Windscreen washer, high-intensity lights, emergency flotation gear, strobe lights, liferaft stowage and improved soundproofing.

Parapublic: Air Equipment SAR hoist (272 kg; 600 lb, 90 m; 295 ft), Spectrolab SX-16 searchlight to port, strobe lights, loudhailer and siren, rappelling rope stays, improved soundproofing and 12 cabin seats.

DIMENSIONS, EXTERNAL:

Main rotor diameter	12.60 m (41 ft 4 in)
Fenestron diameter	1.10 m (3 ft 7 1/4 in)
Main rotor blade chord: basic	0.385 m (1 ft 3 3/4 in)
outboard of tab	0.405 m (1 ft 4 in)
Length: overall, rotor turning	14.30 m (46 ft 11 in)
fuselage	12.71 m (41 ft 8 1/2 in)
Tailplane span; and width, rotor blades folded	3.48 m (11 ft 5 in)
Height: to top of rotor head	3.64 m (11 ft 1 1/4 in)
overall (tip of fin)	4.35 m (14 ft 3 3/4 in)
Wheel track	1.90 m (6 ft 2 3/4 in)
Wheelbase	3.91 m (12 ft 10 in)
Cockpit door (each side): Height	1.34 m (4 ft 4 3/4 in)
Width	1.19 m (3 ft 10 3/4 in)
Baggage compartment door (stbd):	
Height	0.69 m (2 ft 3 3/4 in)
Width	0.73 m (2 ft 4 3/4 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.55 m (8 ft 4 1/2 in)
Max width	2.10 m (6 ft 10 3/4 in)
Max height	1.34 m (4 ft 4 3/4 in)
Floor area	5.09 m ² (54.8 sq ft)
Volume	6.7 m ³ (237 cu ft)
Baggage compartment: Floor area	2.95 m ² (31.8 sq ft)
Volume	2.5 m ³ (88 cu ft)

AREAS:

Main rotor disc	124.69 m ² (1,342.1 sq ft)
Fenestron disc	0.95 m ² (10.23 sq ft)

WEIGHTS AND LOADINGS:

Weight: empty	2,615 kg (5,765 lb)
equipped: Corporate	3,153 kg (6,951 lb)
Offshore	3,027 kg (6,673 lb)
Parapublic	2,876 kg (6,340 lb)
Max underslung load	1,600 kg (3,527 lb)
Max T-O weight	4,920 kg (10,847 lb)
Max disc loading	39.45 kg/m ² (8.08 lb/sq ft)

PERFORMANCE:

Never-exceed speed (VNE)	175 kt (324 km/h; 201 mph)
Max cruising speed at S/L	144 kt (267 km/h; 166 mph)
Econ cruising speed at FL60	146 kt (270 km/h; 168 mph)
Max rate of climb at S/L	354 m (1,161 ft)/min
Service ceiling	4,570 m (15,000 ft)
Hovering ceiling: IGE	2,290 m (7,520 ft)
OGE at 4,400 kg (9,700 lb)	2,365 m (7,760 ft)
Max range with standard fuel, no reserves:	
standard tanks	424 n miles (785 km; 487 miles)
one auxiliary tank	488 n miles (903 km; 561 miles)
Endurance: standard tanks	4 h 0 min
one auxiliary tank	4 h 35 min

EUROCOPTER EC 135 and EC 635

TYPE: Light utility helicopter.

PROGRAMME: First flight on 15 October 1988 of technology prototype, D-HBOX, previously known as BO 108, powered by two Rolls-Royce 250-C20R turboshafts with conventional tail rotor; new all-composites bearingless tail rotor tested during 1990; Eurocopter announced in January 1991 that BO 108 was to succeed BO 105; first flight of second prototype (D-HBEC) powered by two Turbomeca TM 319-1B Arrius, 5 June 1991; production main and tail rotors flight tested during 1992 in preparation for certification programme; design revised late 1992 to increase maximum seating to seven; advanced Fenestron adopted.

Two preproduction prototypes D-HECX and D-HECY made first flights respectively 15 February and 16 April 1994 powered by Turbomeca Arrius 2B and P&WC PW206B intended as production alternatives; third preproduction prototype (D-HECZ) made first flight 28 November 1994, powered by Arrius 2B, and subsequently made type's US debut at HeliExpo '95 in Las Vegas in January 1995; total flight time of first three preproduction EC 135s was nearly 1,600 hours by end 1996, by which time all three preproduction prototypes had been retired. VFR certification to JAR 27 16 June 1996 and to FAR Pt 27 with Category A provisions and for both engine options, 31 July 1996; IFR certification awarded jointly by DGAC (France) and LBA (Germany) on 9 December 1998, while that for CAA attained late 2000; LBA (JAA) single pilot IFR certification achieved 2 December 1999; certified in 17 countries by June 2000; first two production aircraft delivered to Deutsche Rettungsflugwacht on 31 July 1996.

In November 2003 an agreement was signed with Eurocopter Romania for assembly of EC 135s at its Brasov, Romania facility. Other orders resulted in agreements for assembly lines in Spain (Albacete) and Switzerland. Increased MTOW of 2,910 kg (6,415 lb) — previously 2,835 kg (6,250 lb) certified on 21 February 2006 and available from September 2006, in conjunction with reduction of empty weight from 1,490 kg (3,284 lb) to 1,455 kg (3,208 lb).

CURRENT VERSIONS: **EC 135P1:** Pratt & Whitney engine version (PW206B). First two (D-HQQQ and D-HYYY; c/ns 0005 and 0006) delivered on 31 July 1996 to Deutsche Rettungsflugwacht.

EC 135P2: Introduced August 2001, PW206B2 engine with improved contingency ratings.

EC 135T1: Turbomeca engine version. First (0010/N4037A) delivered to USA in November 1996. Early helicopters had 435 kW (583 shp) Arrius 2B engines, later replaced by 500 kW (670 shp) Arrius 2B1. Up-rated Arrius 2B1A engine certified April 2001.

EC 135T2: Deliveries from September 2002. Arrius 2B2 engines.

EC 135 ACT/FHS: Active control technology and flying helicopter simulator; German fly-by-light trials programme: first flight of modified production EC 135 (D-HECV) from Eurocopter's Ottobrunn facility 28 January 2002.

EC 135 APH: Advanced Police Helicopter. Unified mission fit offered by McAlpine Helicopters of UK, 1997; allows simple outfitting with sensors and equipment, according to tasking, using underfuselage pod; typical equipment, including loudspeakers, searchlights, microwave downlink and multisensor turret, can be fitted externally; TV and video equipment carried internally. Pod reduces maximum speed by 5 kt (9 km/h; 6 mph).

EC 635: Military version; mockup was conversion of first preproduction EC 135 (D-HECX). Offered (unsuccessfully) to South Africa and unveiled at Aerospace Africa Air Show on 28 April 1998. First customer was Portuguese Army, which ordered nine EC 635T1s on 22 October 1999 for delivery from June 2001. However, these retrospectively



Spanish Civil Guard Eurocopter EC 135 (Eric Raz)

1040552

cancelled on 14 August 2002, following delay in post-delivery modifications; six sold to Jordan and delivered from July 2003 onwards; Jordan ordered four more in January 2006. CUSTOMERS: Announced customers include Boeing Executive Flight Operations (two in mid-2002) plus one option. Bond, UK (15). Czech Police Aviation Department (eight, for delivery between 2003 and 2008). Deutsche Rettungsflugwacht (German Air Rescue; two); EuropAvia, Switzerland; MFL, France; Helicop of Paris, France (14 EMS versions); Basque Police, Spain; Bavarian Police, Germany (9 with PW206 engines); Sultan of Pahang, Malaysia; OAMTC Austrian Automobile Club (five, delivered from 10 August 1997 followed by order for 11 on 27 September 2000 for delivery between December 2000 and early 2002, and three ordered in June 2003); DAO, Argentina; Laidlaw, UK; Hood, UK; Manichi Press, Japan; Elifriulia, Italy; Proetus, France; Air Service 51, France; Center for Emergency Medicine of Pittsburgh, Pennsylvania (one); Norsk Luftambulans (six); Petroleum Helicopters Inc (three); Temseo of Ketchikan, Alaska (one); TexAir of Houston, Texas (one); ADAC, Germany (12 for EMS); Osterman; Swedish Police (seven, first aircraft handed over 10 August 2001) Haier, China (one in VIP configuration); Helicap, France (two, in EMS configuration) of which first delivered 12 September 2002; Helicesa, Spain (six, in EMS configuration); Romanian Ministry of the Interior (five, of which the first three were delivered in December 2003); the Irish Air Corps, which took delivery of the first of two on 27 September 2005; CJ Systems Aviation Group of the US which ordered 10 in February 2005 to support its air medical services; and Petroleum Helicopters Inc, which ordered 10 with 10 options, on 6 February 2005.

Law enforcement users include Mecklenburg-West Pomerania, Germany (two), Rheinland-Palatinate, Germany (one, delivered 10 July 2002, plus two options), Saxony Police (one), Abu Dhabi Police (one), Chile Police (one), Greek Police (two), Travis County Police Department, USA (one), plus UK police forces (seven). German Army ordered 15 at cost of DM95 million in August 1997 for delivery in 2000 to replace Alouette II in training role of which the first was delivered on 13 September 2000. German Border Guard (Bundesgrenzschutz; BGS) ordered nine (subsequently increased to 11) in December 1997; first three delivered 21 September 2000, with eight in service by end of 2001. Swiss Air Force ordered 18 EC 635s and two VIP EC 135s in April 2006, of which 16 to be assembled locally by RUAG from 2007.

Eurocopter expects to win 700 sales out of a world market for 1,350 during the period 1998 to 2007. More than 550 on order by mid-2006. 100th delivered (to Bavarian Police) on 16 June 1999, and 250th to Spanish operator CoyotAir on 25 October 2002. 300th to UK distributor McAlpine Helicopter Ltd, for North Midlands Police, in September 2003 and 400th to Transporters Aéreos Pegaso of Mexico City in April 2005; 500th to Austrian OAMTC motoring club in August 2006; some two-thirds with Turbomeca engines. Orders in 1999–2005 have comprised 30, 40, 38, 48, 55, 67 and 87.

COSTS: Operating cost 25 per cent lower than BO 105; development programme funded by Eurocopter Deutschland and Eurocopter Canada, suppliers, and German Ministries of Economics and Research and Technology. Czech contract for eight valued at €36 million (2003).

DESIGN FEATURES: Designed to FAR Pt 27 including Category A and European JAR 27; pod-and-boom configuration, with Fenestron; forward flight stability by two horizontal and four vertical (fin, underfin and two endplates) surfaces; four-blade FVW bearingless main rotor, single-piece rotor head/mast; rotor rpm are variable; composites blades mounted on controlled flexibility composites arms giving flap, lag and pitch-change freedom; control demands transmitted from rods to root of blade by rigid CFRP pitch cuffs; main rotor blades have DM-H3 and -4 aerofoils with non-linear twist and tapered transonic tips; main rotor axis tilted forward 5°.

Airframe drag 30 per cent lower than BO 105 by clean and compact external shape; cabin height retained by shallow two-stage transmission; vibration reduced by ARIS mounting between transmission and fuselage; all dynamically loaded components to have 3,500 hours MTBR or be maintained on-condition. Fenestron has 10 asymmetrically spaced blades.

Second BO 108 prototype had EFIS-based IFR system; fuselage stretched 15 cm (5.9 in) and interior cabin width extended by 10 cm (3.9 in); main rotor diameter extended to 10.20 m (33 ft 5½ in); for EC 135, tail rotor replaced in 1992 by New Generation Fenestron with 11 fixed flow-straightening vanes in fan efflux designed to avoid momentum losses and improve fan figure of merit; vanes are swept relative to radius and fan has different



Military Eurocopter EC 635 with rocket pods (Wolfgang Obrusnik)

1040556

number of blades to avoid shocks and reduce noise; fan blade tip speed is only 185 m (607 ft)/s; maximum T-O weight increased to 2,720 kg (5,997 lb).

FLYING CONTROLS: Conventional hydraulic fully powered controls with integrated electrical SAS servos; objective is single-pilot IFR with cost-effective stability augmentation. Electric cyclic trim system.

STRUCTURE: Fibre-reinforced composites main rotor blades; single-piece rotor head/mast. Airframe mainly Kevlar/CFRP sandwich composites, except aluminium alloy sidewalls, pod lower module and cabin floor, tailboom and around cargo area; some titanium in engine bay; composites tailplane.

LANDING GEAR: Skid type; ground handling wheels can be fitted.

POWER PLANT: Choice of turboshaft engines. Turbomeca-engined aircraft have two Arrius 2B2s, each giving 473 kW (634 shp) at T-O, 442 kW (592 shp) maximum continuous, 528 kW (708 shp) OEI continuous, 580 kW (777 shp) for 2 minutes with OEI and 609 kW (816 shp) for 30 seconds. Alternative power plant is two Pratt & Whitney Canada PW206B2s, each giving 498 kW (667 shp) at T-O, 457 kW (612 shp) maximum continuous, 528 kW (708 shp) OEI continuous, 580 kW (777 shp) for 2 minutes with OEI and 609 kW (816 shp) for 30 seconds. Both types of engine have FADEC. Combined transmission rating 640 kW (858 shp) maximum T-O, 567 kW (760 shp) maximum continuous, 368 kW (493 shp) OEI continuous, 513 kW (687 shp) for 2 minutes with OEI and 526 kW (705 shp) for 30 seconds.

Fuel capacity of first 249 aircraft 673 litres (178 US gallons; 148 Imp gallons) of which 663 litres (175 US gallons; 146 Imp gallons) are usable. Capacity 700 litres (185 US gallons; 154 Imp gallons) from No. 250. Additional long-range tank optional, usable capacity 198.5 litres (52.4 US gallons; 43.7 Imp gallons). Optional self-sealing fuel tanks. Oil capacity 8 litres (2.0 US gallons; 1.75 Imp gallons).

ACCOMMODATION: Seven persons, including one or two pilots, in standard version, or six persons in VIP version; optional max capacity of eight. Four-point harnesses for front seats; three-point harnesses for remaining seats. Forward-hinged doors for two front occupants; sliding doors for five persons in cabin. Rear of pod has clamshell doors for bulky items/cargo; flights permissible with clamshell doors removed; optional window in each rear door. Unobstructed cabin interior. EMS variant can accommodate one pilot with two stretcher cases and two seated medical staff/attendants; alternative layouts for one, one, three, or two, one, three, or two, two, two.

SYSTEMS: Redundant 28 V DC electrical supply systems to JAR/FAR 27 standards; two 160 A 28 V starter/generators and 24 V 17 Ah Ni/Cd batteries in Arrius 2B variant, two 200 A 28 V starter/generators and 24 V 25 Ah Ni/Cd batteries in PW206B variant. Fully redundant dual hydraulic systems. NATO standard external power connector.

AVIONICS: Bendix/King Gold Crown and Thales equipment. Total of 10 standard avionics and equipment packages available.

Radar: Provision for integrated weather radar.

EUROCOPTER EC 120 B COLIBRI

English name: Hummingbird
Spanish Air Force designation: HE.25
Chinese designation: HC120
TYPE: Light utility helicopter.

PROGRAMME: Definition phase of original P120L launched 15 February 1990; subsequently redesigned with 500 kg (1,102 lb) lower gross weight and new engine and rotor; development contract signed October 1992; redesignated EC 120, January 1993; design definition completed mid-1993; assembly of first of two prototypes began at Eurocopter France at Marignane in early 1995; first flight (F-WWPA) 9 June 1995; second prototype (F-WWPD) flown 17 July 1996; certification to JAR 27 was achieved on 16 June 1997 (following Arrius 2F engine approval by DGAC on 22 January 1997); FAR Pt 27 certification on 28 January 1998; operations in cold weather certified late 1998; first production EC 120 (c/n 1005) flew 5 December 1997 before delivery to Japanese distributor Nosaki on 23 January 1998 for eventual use (as JA120B) by Nosaki Sangyo, Osaka.

Eurocopter has 61 per cent share and responsible for instrument panel, landing gear, seats, rotor system, transmission, final assembly, flight test and certification; CATIC (China National Aero-Technology Import & Export Corporation in the form of Hafei Aviation Industry Company; 24 per cent) for cabin structure and doors, engine cowlings, pod central and intermediate structure and fuel system; and Singapore Technologies Aerospace (15 per cent) for tailboom, fin, horizontal stabiliser, Fenestron, general doors and instrument pedestal. Joint design team working in Eurocopter France at Marignane. Global support system, with 13 product centres, being initiated. Australian assembly centre established as part of offsets for 2001 purchase of Tiger attack helicopters by Australian Army, with first two Australian-assembled EC 120 BSS completed in 2003. Agreement signed with AVIC II of China in November 2003 for establishment of production line at Harbin with target output of 20 per year.

CUSTOMERS: Delivery of 400th EC 120 (N288JK of Sacramento County Sheriff's Department) effected in September 2006. Recent customers include the Spanish Air Force, which ordered 15 in 1999 for basic training; deliveries began 26 July 2000 and were completed in July 2001; and Air Logistics, which took delivery of six in 2001 for offshore operations in the Gulf of Mexico. Three ordered for Indonesian Navy and 12 for Indonesian Air Force; deliveries began June 2001. 100th aircraft handed over 19 April 2000 to a German customer; 200th to a Swedish customer on 29 March 2001; 300th to Australian customer 8 November 2002. Selected 5 October 2004 by US Department of Homeland Security for US Border Patrol, with firm order for 55, plus five options. Orders in 1999–2005 were 36, 61, 81, 38, 38, 35 and 44. Total market estimated at 1,600 to 2,000 during production life. COSTS: USD840,000 (1999). US Border Patrol order for 55, plus five options, valued at USD75 million (2004).

DESIGN FEATURES: Pod-and-boom layout; horizontal stabilisers, fin and underfin for directional stability; anti-torque Fenestron. Three-blade main rotor on Spheriflex hub rotating clockwise (nominal rotor speed 406 rpm) integrated with main shaft and transmission; two-stage reduction gear; rotor brake; eight asymmetrically positioned bladed New Generation Fenestron (nominal tail rotor speed 4,567 rpm). External noise almost 7 dB below ICAO limits. Single level cabin floor. Engine mounted to left of main rotor mast to improve balance by counteracting main rotor downwash.

FLYING CONTROLS: Control forces on collective and cyclic reduced by three electrically actuated hydraulic servos operating at 37 bar (537 lb/sq in). Tab on each main rotor blade trailing-edge at three-quarter span.

STRUCTURE: Main rotor blades have carbon fibre rib with foam filler and glass fibre skin, plus stainless steel attachment bushes and leading-edge. Titanium alloy Spheriflex head and shaft made as single composites assembly; metal centre-fuselage; light alloy skid landing gear; crashworthy seats and fuel system. Light alloy tail rotor shaft.

LANDING GEAR: 'Moustache' configuration of fixed skids, having sweptback forward supports and full-width boarding step. Optional 1.50 m (4 ft 11 in) skis for snow operations.

POWER PLANT: One Turbomeca TM 319 Arrius 2F engine selected for first 300 EC 120s; rating 376 kW (504 shp) for T-O, 335 kW (449 shp) max continuous. Transmission rating 330 kW (442 shp). Fuel capacity 416 litres (109.9 US gallons; 91.5 Imp gallons) in two tanks (one located beneath cabin floor and one above baggage compartment); usable fuel 406 litres (107 US gallons; 89.3 Imp gallons).

ACCOMMODATION: Pilot and four passengers (or pilot, patient and paramedic in HEMS configuration); two front seats and one rear bench seat. Large door, front, starboard; hinged front and rear sliding door, port. Compartment below engine on same level as cabin floor, accessible from cabin, by external side door and rear door. Seating conforms to new FAR Pt 27 requirements for 30 g vertical and 18 g horizontal deceleration. Dual controls optional. Accommodation ventilated and heated; air conditioning optional.

SYSTEMS: VEMD (vehicle and engine multifunction display), fitted as standard, is a fully duplex three-module processing system using two glass screens to monitor performance and maintenance requirements. Electrical system includes 4.5 kW 28 V DC starter/generator and Ni/Cd battery.

AVIONICS: To customer's requirements. Six standard packages available for passenger transport (two), law enforcement, training (two) and utility.

Comms: Bendix/King: KX 165 nav/com/glideslope and secondary KY 196A VHF, Jolet JE2 NG ELT, Bendix/King KT 76A transponder and Team SIB 120 interphone in typical passenger configuration.

Flight: Trimble TNL 2101 GPS with moving map in typical passenger configuration.

Instrumentation: Standard fit of VEMD, ASI, NR/NF dual indicator and altimeter.

Flight: Air data computer; SFIM automatic flight control system (AFCS); GPS. Honeywell combined solid-state flight data and cockpit voice recorder tested on EC 135 late 1998. BGS aircraft have EADS-Dornier Hellas obstacle warning system. Optional Bendix/King Mark XXII EGPWS available for EC 135 APH.

Instrumentation: Liquid crystal dual-screen (Thales SMD45) vehicle and engine management displays with AN equipment.

Mission: Optional FLIR and NVGs for military, police and ambulance roles. BGS EC 135s are first to be equipped with Hellas laser obstacle warning system.

EQUIPMENT: Options include cargo hook, external loudspeakers and searchlights, rescue winch (230 kg; 507 lb) with 50 m (164 ft) cable, emergency floats, sand filter, wire-strike protection system and light armour protection.

ARMAMENT: By 2003, approved to carry FN Herstal HMP 400 12.7 mm machine gun, Giat NC621 20 mm gun or 12-round 70 mm rocket launcher on pylons.

DIMENSIONS, EXTERNAL:

Main rotor diameter	10.20 m (33 ft 5½ in)
Fenestron diameter	1.00 m (3 ft 3¼ in)
Length: overall, rotor turning	12.16 m (39 ft 10¾ in)
fuselage: incl boom	10.20 m (33 ft 6½ in)
excl boom	5.87 m (19 ft 3 in)
Height: overall	3.51 m (11 ft 6 in)
to top of rotor head	3.35 m (11 ft 0 in)
Width:	
without rotor blades (tailplane span)	2.65 m (8 ft 8¼ in)
fuselage (max)	1.56 m (5 ft 1½ in)
Skid length	3.20 m (10 ft 6 in)
Skid track	2.00 m (6 ft 6¾ in)
Ground clearance: fuselage	0.40 m (1 ft 3¾ in)
tailboom underfin	0.66 m (2 ft 2 in)

DIMENSIONS, INTERNAL:

Cabin and cockpit:	
Length: normal	3.06 m (10 ft 0½ in)
with EMS floor extension	4.11 m (13 ft 5¾ in)
Max width	1.50 m (4 ft 11 in)
Max height	1.26 m (4 ft 1½ in)
Floor area	4.3 m² (46 sq ft)
Volume: EC 135	4.8 m³ (170 cu ft)
EC 635	4.6 m³ (162 cu ft)
Baggage compartment: Length	1.05 m (3 ft 5¼ in)
Max width	1.23 m (4 ft 0½ in)
Max height	0.70 m (2 ft 3½ in)
Floor area	1.20 m² (12.9 sq ft)
Volume	1.1 m³ (39 cu ft)

AREAS:

Main rotor disc	81.71 m² (879.5 sq ft)
Fenestron disc	2.84 m² (30.52 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: EC 135	1,455 kg (3,208 lb)
EC 635	1,530 kg (3,373 lb)
Max fuel: standard (No. 250 on)	560 kg (1,235 lb)
with long-range tank	720 kg (1,587 lb)
Max external load	1,360 kg (2,998 lb)
Max T-O weight	2,910 kg (6,415 lb)
Max disc loading	35.6 kg/m² (7.29 lb/sq ft)
Transmission loading at max T-O weight and power	4.73 kg/kW (7.77 lb/shp)

PERFORMANCE (A: Arrius 2B2, B: PW206B2, at normal MTOW):

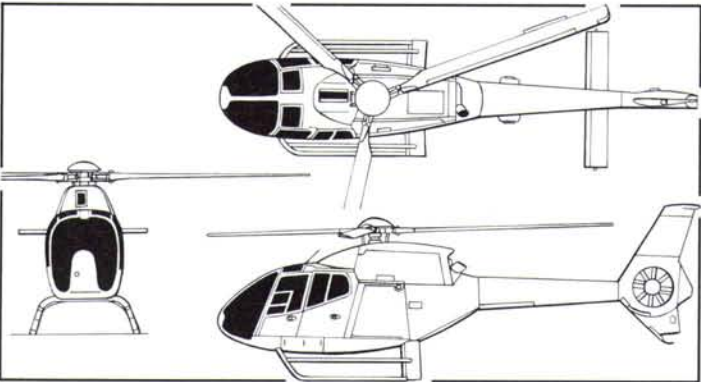
Never-exceed speed (VNE):	
A, B	140 kt (259 km/h; 161 mph)
Max cruising speed: A, B	138 kt (256 km/h; 159 mph)
Econ cruising speed: A	129 kt (239 km/h; 148 mph)
B	124 kt (230 km/h; 143 mph)
Max rate of climb at S/L: A, B	457 m (1,500 ft)/min
Rate of climb at S/L, OEI: A, B	65 m (215 ft)/min
Max certified altitude: A, B	3,050 m (10,000 ft)
Service ceiling, OEI: A	3,050 m (10,000 ft)
B	2,925 m (9,600 ft)
Max certified hovering ceiling, IGE:	
A, B	3,050 m (10,000 ft)
Hovering ceiling, OGE: A, B	1,830 m (6,000 ft)
Range at S/L, standard fuel (700 litres):	
A	335 n miles (620 km; 385 miles)
B	342 n miles (635 km; 394 miles)
Ferry range with long-range tank:	
A	440 n miles (814 km; 506 miles)
B	450 n miles (833 km; 517 miles)
Endurance at S/L, standard fuel (700 litres):	
A	3 h 23 min
B	3 h 35 min



Eurocopter EC 135 seven-seat, twin-engined helicopter (Mike Keep) 0507504



Eurocopter EC 120 Colibri (Patrick Penna) 1040567



Eurocopter EC 120 B Colibri single-engined light helicopter (James Goulding) 0099566

EQUIPMENT: Optional Aerazur emergency flotation bags, and cable cutters. Optional pilot-controllable swivelling landing light. Optional windscreen wipers.

DIMENSIONS, EXTERNAL:

Main rotor diameter	10.00 m (32 ft 9 3/4 in)
Main rotor blade chord	0.26 m (10 1/4 in)
Fenestron diameter	0.75 m (2 ft 5 1/2 in)
Fenestron blade chord	0.06 m (2 1/4 in)
Length overall, rotors turning	11.52 m (37 ft 9 1/2 in)
Fuselage: Length	9.60 m (31 ft 6 in)
Max width of cabin	1.50 m (4 ft 11 in)
Max depth, excl skids:	
to engine cowling	1.67 m (5 ft 5 3/4 in)
to rotor head	2.52 m (8 ft 3 3/4 in)
Tailplane span	2.60 m (8 ft 6 1/4 in)
Height: overall	3.40 m (11 ft 1 3/4 in)
to top of rotor head	3.08 m (10 ft 1 1/4 in)
to top of engine cowling	2.23 m (7 ft 3 3/4 in)
Skid track	2.07 m (6 ft 9 1/2 in)
Height of skids	0.56 m (1 ft 10 in)
Height of boarding step	0.50 m (1 ft 7 3/4 in)
Large door, starboard: Width	1.15 m (3 ft 9 1/4 in)
Height	1.16 m (3 ft 9 3/4 in)
Front door, port: Width	0.81 m (2 ft 8 in)
Height	1.16 m (3 ft 9 3/4 in)
Sliding door, port: Width	0.90 m (2 ft 11 1/2 in)
Height	1.16 m (3 ft 9 3/4 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.30 m (7 ft 6 1/2 in)
Max width	1.35 m (4 ft 5 1/4 in)
Max height	1.25 m (4 ft 1 1/4 in)
Floor area	3.0 m ² (32.29 sq ft)
Volume	2.14 m ³ (75.6 cu ft)
Baggage compartment: Length	1.31 m (4 ft 3 1/2 in)
Max width	0.72 m (2 ft 4 1/4 in)
Max height	1.02 m (3 ft 4 1/4 in)
Volume	0.8 m ³ (28.25 cu ft)

AREAS:

Main rotor disc	78.54 m ² (845.4 sq ft)
Fenestron disc	0.44 m ² (4.73 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: standard	960 kg (2,116 lb)
typical passenger fit	1,007 kg (2,220 lb)
typical law enforcement fit	985 kg (2,172 lb)
advanced training fit	1,021 kg (2,251 lb)
Max sling load	700 kg (1,543 lb)
Max useful load	755 kg (1,664 lb)
Max T-O weight: internal load	1,715 kg (3,781 lb)
external load	1,800 kg (3,968 lb)
Max disc loading:	
internal load	21.8 kg/m ² (4.47 lb/sq ft)
external load	22.9 kg/m ² (4.69 lb/sq ft)
Transmission loading at max T-O weight and power:	
internal load	5.20 kg/kW (8.54 lb/shp)
external load	5.45 kg/kW (8.96 lb/shp)

PERFORMANCE (at 1,715 kg; 3,781 lb):

Never-exceed speed (VNE)	150 kt (278 km/h; 173 mph)
Cruising speed: max	122 kt (226 km/h; 140 mph)
econ	103 kt (191 km/h; 119 mph)
Max rate of climb at S/L	366 m (1,200 ft)/min
Service ceiling	5,180 m (17,000 ft)
Hovering ceiling: IGE	2,820 m (9,260 ft)
OGE	2,320 m (7,620 ft)
Range, no reserves	393 n miles (727 km; 452 miles)
Endurance, no reserves	4 h 32 min

EUROCOPTER BK 117

TYPE: Light utility helicopter.

PROGRAMME: Developed jointly by partners; four prototypes, first flight 13 June 1979; one preproduction aircraft, first flight 6 March 1981; first flights of production aircraft 24 December 1981 (JQ1001 in Japan) and 23 April 1982 (in Germany); certified in Germany and Japan 9 and 17 December 1982 respectively, followed by US FAA 29 March 1983 (FAR Pt 29, Categories A and B, including Amendments 29-1 to 29-16); deliveries began early 1983. See 1991-92 and previous editions for earlier A series and B-1. BK 117 fleet reached 1,274,000 flying hours by January 2001, at which time 416 delivered and 379 remaining in service.

In October 2001, Eurocopter announced plans for transfer of production from Donauwörth to Trento, Italy, where seven to be produced annually by Avionline (jointly



Eurocopter BK 117 C-1 (Daniel Bauchere) 1040571

owned by Aerosud Elicotteri and Helicopters Italia); marketing and delivery remain unchanged. By late 2006 none appeared to have been built in Italy.

CURRENT VERSIONS: **BK 117 B-2:** Production completed in 1998.

BK 117 C-1: Turbomeca Arriel 1E2 engines first flown in converted BK 117A/B (F-WMBB) 6 April 1990; German LBA certification 17 January 1992; US FAA certification 7 December 1992; first delivery (to USA) December 1992. French DGAC certification 15 July 1993. Performance similar to that of BK 117 B-2; better hot-and-high performance.

Production BK 117 C-1 additionally features higher transmission and engine OEI ratings, new tail rotor blades and variable rotor speed to improve tail rotor thrust and reduce external noise, and torque matching system to reduce pilot workload.

Prototype C-1 (D-HECD) built 1992; exports began, to USA, December 1992. German LBA certification achieved 28 April 1994, followed by US FAA certification 29 September 1994. Italian RAI certification 24 November 1994, and UK CAA certification 28 July 1995. Japanese (Kawasaki-built) version, which includes both re-engine and above improvements, was approved 8 June 1995 by Japanese CAB.

Details below apply to BK 117 C-1 version.

BK-117 C-2: Described separately as EC 145.

NBK-117: Designation of aircraft built by IPTN (now Dirgantara) under November 1982 agreement with MBB. Three only; no longer produced.

BK 117 P5: Advanced technology demonstrator in Japan; fly-by-wire control system.

EC-Futura BK117: Technology demonstrator, first flown July 1999 at Ottobrunn, used as part of All Weather Rescue Helicopter programme.

EC 145: See separate entry.

CUSTOMERS: Total of 440 (including prototypes) built by MBB/Eurocopter up to December 2004; no further examples recorded in following two years. Orders 1997-2003 were seven, five, three, seven, two, three and six. Customers include TsENTROSPAS of Russia (two, delivered 1998 and December 2000), Greek Fire Brigade (two, delivered June 2001), Telmex of Mexico (2001), First Security Bank of USA (October 2002), Virginia State Police (2002) and Italian EMS operators Aeroveneta, (2000) and Alidaunia (2001). Kawasaki production had reached 132 by late 2002; 133rd registered in mid-2006.

DESIGN FEATURES: Pod-and-boom configuration, latter mounted high for cabin access via rear freight doors; tail rotor mounted at fin tip; large auxiliary fins at tip of each horizontal stabiliser; engines above cabin.

System Bolkow four-blade main rotor head, almost identical to that of BO 105; main rotor blades similar to but larger than those of BO 105, with NACA 23012/23010 (modified) section; optional two-blade folding. Two-blade semi-rigid tail rotor with MBB-S102E performance/noise optimised blade section; rotor rpm 383 (main), 2,169 (tail).

FLYING CONTROLS: Equipped as standard for single-pilot VFR operation; dual controls and dual VFR instrumentation optional; rotor brake and yaw CSAS standard on German-built versions, optional on Kawasaki aircraft; options include IFR instrumentation, two-axis (pitch/roll) CSAS and Honeywell SPZ-7100 dual digital AFCS. Mast moment indicator discourages excessive cyclic control inputs.

STRUCTURE: Main rotor has one-piece titanium hub with pitch-change bearings; fail-safe GFRP blades with stainless steel anti-erosion strip. Tail rotor, mounted on port side of central fin, has GFRP blades of high-impact resistance. Main fuselage pod and tailboom are aluminium alloy with single-curvature sheets and (on fuselage) bonded aluminium sandwich panels; secondary fuselage components are compound curvature shells of Kevlar sandwich. Engine deck, to which tailboom is integrally attached, forms cargo compartment roof and is of titanium adjacent engine bays. Detachable tailcone carries main fin/tail rotor support, and horizontal stabiliser with offset endplate fins.

Eurocopter responsible for rotor systems, tailboom, tail unit, skid landing gear, hydraulic system, engine firewall and cowlings, powered controls and systems integration; Kawasaki for fuselage, transmission, fuel and electrical systems, and standard equipment. Components single-sourced and exchanged for separate assembly lines at Donauwörth and Gifu; some components and accessories interchangeable with those of BO 105 (which see), from which hydraulic-powered control system is also adapted.

LANDING GEAR: Non-retractable tubular skid type, of aluminium construction. Skids are detachable from cross-tubes. Ground handling wheels standard. Emergency flotation gear, settling protectors and snow skids optional.

POWER PLANT: BK 117 B-2 has two Honeywell LTS 101-750B-1 turboshafts, each rated at 410 kW (550 shp) for take-off and maximum continuous power, 441 kW (592 shp) for 30 minutes with OEI. BK 117 C-1 has two Turbomeca Arriel 1E2 turboshafts each rated at 550 kW (738 shp) for take-off, 516 kW (692 shp) maximum continuous and 574 kW (770 shp) for 2 1/2 minutes OEI.

Kawasaki KB 03 main transmission rated at 736 kW (986 shp) for twin-engine T-O, 632 kW (848 shp) maximum continuous; for single-engine operation, 550 kW (738 shp) allowed for 2 1/2 minutes, 404 kW (542 shp) for maximum continuous (see also BK 117 C-1 improvements).

Fuel in four flexible bladder tanks (forward and aft main tanks, with two supply tanks between), in compartments under cabin floor. Two independent fuel feed systems for engines and common main fuel tank. Total standard fuel capacity 697 litres (184 US gallons; 153 Imp gallons), of which 685 litres (181 US gallons; 151 Imp gallons) are usable; single or twin internal auxiliary fuel tanks, each of 200 litres (52.8 US gallons; 44.0 Imp gallons) capacity, and two external auxiliary fuel tanks, each of 150 litres (39.6 US gallons; 33.0 Imp gallons), optional.

ACCOMMODATION: Pilot and up to six (executive version), seven (Eurocopter standard version) or nine passengers (Kawasaki version). High-density layouts available for up to 10 passengers in addition to pilot. Level floor throughout cockpit, cabin and cargo compartment. Jettisonable forward-hinged door on each side of cockpit, pilot's door having an openable window. Jettisonable rearward-sliding passenger door on each side of cabin, lockable in open position. Fixed steps on each side. Two hinged, clamshell doors at rear of cabin, providing straight-in access to cargo compartment. Rear cabin window on each side.

Aircraft can be equipped for offshore support, medical evacuation (one or two stretchers side by side and up to six attendants), firefighting, search and rescue, law enforcement, cargo transport or other operations.

SYSTEMS: Ram air and electrical ventilation system. Fully redundant tandem hydraulic boost system (one operating and one standby), pressure 103.5 bar (1,500 lb/sq in), for flight controls. System flow rate 8.1 litres (2.14 US gallons; 1.78 Imp gallons)/min. Bootstrap/oil reservoir, pressure 1.70 bar (25 lb/sq in). Main DC electrical power from two 150 A 28 V (200 A 28 V for C-1) starter/generators (one on each engine) and a 24 V 25 Ah Ni/Cd battery. AC power provided by inverter; second AC inverter optional; emergency busbar provides direct battery power to essential services, external DC power receptacle.

AVIONICS: *Comms:* VHF-AM/FM, UHF and HF radios to customer's requirements.

Flight: Long-range nav aids optional.

Radar: Multirole radar optional.

Instrumentation: Basic instrumentation for single-pilot VFR operation includes airspeed indicator with two electrically heated pitot tubes and static ports, two hydraulic pressure indicators, encoding altimeter, instantaneous vertical speed indicator, 4 in artificial horizon, 3 in standby artificial horizon, HSI (4 in and 3 in artificial horizons and HSI optional on Kawasaki-built aircraft), gyro magnetic heading system, magnetic compass, ambient air temperature thermometer and clock.

EQUIPMENT: Standard basic equipment includes rotor brake, annunciator panel, two master caution lights, rotor rpm/engine fail warning control unit, fuel quantity indicator and low-level sensor, outside air temperature indicator, engine and transmission oil pressure and temperature indicators, two exhaust temperature indicators, dual torque indicator, triple tachometer, two NI tachometers, full internal and external lighting, ground handling wheels, pilot's windscreens wiper, floor covering, interior panelling and sound insulation, ashtrays, map/document case, tiedown rings in cabin and cargo compartment, engine compartment fire warning indicator, engine fire extinguishing system, portable fire extinguisher, first aid kit, and single-colour exterior paint scheme.

Optional equipment includes long-range fuel tanks, high-density seating arrangement, bleed air heating system, crashworthy seats, emergency flotation gear, settling protectors, snow skids, main rotor blade folding kit, dual pilot operation kit, stretcher installation, external cargo hook for 1,500 kg (3,307 lb) maximum load, rescue hoist (90 m; 295 ft cable, maximum load 270 kg; 595 lb, variable winch speed), Spectrolab SX 16 remotely controlled searchlight, external loudspeaker, sand filter and kits for rescue, law enforcement, firefighting and VIP transport.

Active anti-vibration system certified in Japan in mid-1997; available as option or for retrofit.

DIMENSIONS, EXTERNAL:

Main rotor diameter	11.00 m (36 ft 1 in)
Tail rotor diameter	1.96 m (6 ft 5 in)
Tail rotor blade chord	0.22 m (8¾ in)
Length: overall, both rotors turning	13.01 m (42 ft 8¼ in)
fuselage, tail rotor blades vertical	9.93 m (32 ft 7 in)
Fuselage: Max width	1.60 m (5 ft 3 in)
Height: overall, both rotors turning	3.85 m (12 ft 7½ in)
to top of main rotor head	3.36 m (11 ft 0¼ in)
Tailplane span (over endplate fins)	2.71 m (8 ft 10¾ in)
Ground clearance: tail rotor	1.89 m (6 ft 2½ in)
fuselage	0.35 m (1 ft 1¾ in)
Skid track	2.50 m (8 ft 2½ in)

DIMENSIONS, INTERNAL:

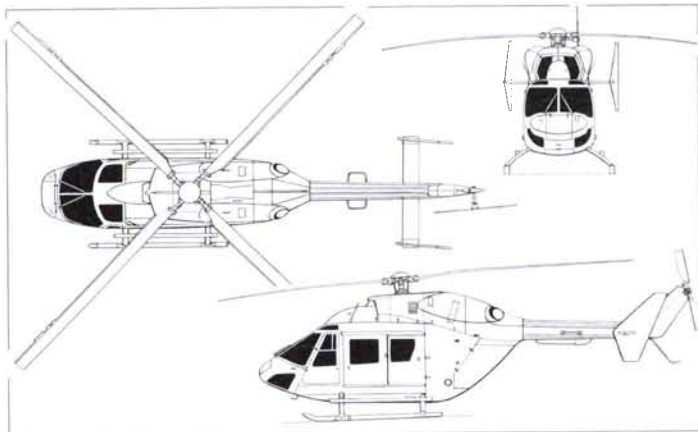
Combined cabin and cargo compartment:	
Max length	3.02 m (9 ft 11 in)
Width: max	1.59 m (5 ft 2½ in)
min	1.27 m (4 ft 2 in)
Height: max	1.28 m (4 ft 2½ in)
min	0.99 m (3 ft 3 in)
Useful floor area	3.70 m² (39.8 sq ft)
Volume	5.0 m³ (177 cu ft)
Cabin only: Length	2.56 m (8 ft 4¾ in)

AREAS:

Main rotor blades (each)	1.76 m² (18.94 sq ft)
Tail rotor blades (each): B-2	0.098 m² (1.05 sq ft)
C-1	0.108 m² (1.16 sq ft)
Main rotor disc	95.03 m² (1,022.9 sq ft)
Tail rotor disc	3.00 m² (32.24 sq ft)

WEIGHTS AND LOADINGS:

Basic weight empty: B-2	1,745 kg (3,846 lb)
C-1	1,764 kg (3,890 lb)
Fuel: standard usable	558 kg (1,230 lb)
incl first auxiliary tank	718 kg (1,583 lb)
Max T-O weight: internal payload	3,350 kg (7,385 lb)
external payload	3,500 kg (7,716 lb)
Max disc loading:	
internal payload	35.25 kg/m² (7.22 lb/sq ft)
external payload	36.8 kg/m² (7.54 lb/sq ft)



Eurocopter BK 117 B-2 twin-turboshaft multipurpose helicopter (Dennis Punnett)

0507163

Transmission loading at max T-O weight and power:

internal payload	4.55 kg/kW (7.48 lb/shp)
external payload	4.76 kg/kW (7.83 lb/shp)

PERFORMANCE (main values for BK 117 C-1; A: at gross weight of 3,000 kg; 6,614 lb; B: at 3,200 kg; 7,055 lb; C: at 3,350 kg; 7,385 lb):

Never-exceed speed (VNE) at S/L:

A	150 kt (277 km/h; 172 mph)
B, C	140 kt (259 km/h; 161 mph)

Max cruising speed: A

B	135 kt (250 km/h; 155 mph)
C	134 kt (248 km/h; 154 mph)

Econ cruising speed: A

B	133 kt (246 km/h; 153 mph)
C	127 kt (235 km/h; 146 mph)

Max rate of climb at S/L: A

B	655 m (2,150 ft)/min
C	587 m (1,925 ft)/min

Max certified altitude: A, B, C

C	538 m (1,765 ft)/min
A, B	4,575 m (15,000 ft)

Service ceiling: A, B

C	5,480 m (18,000 ft)
A	5,090 m (16,700 ft)

Hovering ceiling IGE (zero wind):

A	3,690 m (12,100 ft)
B	3,050 m (10,000 ft)
C	2,530 m (8,300 ft)

Hovering ceiling IGE (20 kt; 37 km/h; 23 mph) crosswind: A

B	3,200 m (10,500 ft)
C	2,530 m (8,300 ft)

Hovering ceiling OGE: A

B	1,920 m (6,300 ft)
C	3,520 m (11,550 ft)

Range: C

A	3,000 m (9,840 ft)
B	1,480 m (4,860 ft)

Endurance: B, C

C	292 n miles (540 km; 336 miles)
A	2 h 50 min

EUROCOPTER EC 145

Japanese designation: BK 117C-2

US Army designation: UH-72A Lakota

TYPE: Light utility helicopter.

PROGRAMME: Incorporation of EC 135 technology into BK 117 (see separate entry for Eurocopter BK 117) began in 1997; named EC 145 in late 1999, but retains engineering designation BK 117C-2 and is marketed in Japan as such. First flight of German aircraft (D-HMBK) (unannounced) 12 June 1999; first flight of Japanese prototype 15 March 2000; third prototype (D-HMBL) joined programme 14 April 2000; fourth (D-HMBM) on 27 October 2000. Kawasaki builds tail section; Eurocopter responsible for forward section. Certification by LBA received 12 December 2000; commercial launch at Paris Air Show, June 2001; FAA certification awarded 14 February 2002, coincident with type's formal "introduction" at HeliExpo, Orlando, Florida.

CUSTOMERS: Launch customer was French Sécurité Civile, which ordered 32 in December 1997 for delivery between 2001 and 2006 to replace Alouette III; two preproduction examples delivered May 2001 for familiarisation; first production example (F-ZBPA) formally handed over at Nîmes-Garons 24 April 2002; initial batch of 15 received by mid-2003, with final delivery taking place on 19 May 2005. Second customer is French Gendarmerie, with firm order for eight placed in 1999; deliveries began 2002 and initial batch of five received by mid-2003. ADAC (German Automobile Club) ordered two in June 2001 to become civilian launch customer; delivered in 2002. Eight ordered in 2001, including four for Rega HEMS in Switzerland, delivered from 21 November 2002. Two for Hesse Police (Germany) delivered from April 2002. 50th production EC145 (F-ZBPY) delivered to Sécurité Civile on 31 March 2004. Total 13 BK 117/EC 145s delivered in 2004 and 20 EC 145s in 2005. Recent customers include SOS Helicopter Gotland AB of Sweden, which took delivery of one for EMS operation in October 2005.

CURRENT VERSIONS: EC 145: As described.

UH-72A Lakota: Described separately.

COSTS: Sécurité Civile contract valued at USD170 million. Flyaway cost unofficially reported as USD4.9 million (2000).

DESIGN FEATURES: Fuselage redesigned forward of engines; new nose, based on EC 135 profile. Redesigned tail rotor. Optimised for SAR and emergency roles.

STRUCTURE: As BK 117.

LANDING GEAR: As BK 117.

POWER PLANT: Two Turbomeca Arriel 1E2 turboshafts, each rated at 550 kW (738 shp) for take-off, 516 kW (692 shp) maximum continuous and 574 kW (770 shp) for 2½ minutes' OEI. Main transmission rated at 776 kW (1,040 shp) for twin-engine T-O, 632 kW (848 shp) maximum continuous; for single-engine operation 551 kW (739 shp) allowed for 2½ minutes, 404 kW (542 shp) for maximum continuous. Standard fuel contained in main tank, usable capacity 741.5 litres (195.7 US gallons; 163.1 Imp gallons) and left and right



Eurocopter EC 145 of French Sécurité Civil (Patrick Penna)

1040569



German emergency medical service Eurocopter EC 145 (Wolfgang Obrusnik)

1153694

supply tanks, usable capacities 59 litres (15.6 US gallons; 13.0 Imp gallons) and 67 litres (17.7 US gallons; 14.7 Imp gallons respectively, for total capacity of 867.5 litres (229.0 US gallons; 190.8 Imp gallons). Optional long-range tanks increase usable capacity to 1,086 litres (287 US gallons; 239 Imp gallons).

ACCOMMODATION: Compared with BK 117, cabin is more spacious through removal of centre post and door supports.

SYSTEMS: As BK 117.

AVIONICS: Standard packages available for single/dual pilot IFR (as described), single pilot VFR and single pilot IFR.

Comms: Twin Becker ACU 5100 control panels and VCS 40A VHF-AM, IC 3100 intercom, MST 67A Mode S transponder, Artex C-406-2 ELT, Optional second IC 3100 and C406-2.

Radar: Optional Telephonics RDR 1400C weather radar and SMD 45 display.

Flight: Bendix/King KRA 405B radar altimeter; DMS 44A DME, twin VNS 41A VOR/ILS. Optional second KRA 405B, Chelton DFS 43A direction finder, Freeflight 2101 GPS and dual Canadian Marconi CMA 3000 management system.

Instrumentation: Four SMD 45 LCD displays (two primary, two navigation).

EQUIPMENT: As BK 117.

DIMENSIONS, EXTERNAL: As BK 117C-1, except:

Main rotor diameter	11.0 m (36 ft 1 in)
Tail rotor diameter	1.96 m (6 ft 5¼ in)
Length: overall, both rotors turning	13.03 m (42 ft 9 in)
fuselage, tail rotor blades vertical	10.19 m (33 ft 5¼ in)
Fuselage max width	1.84 m (6 ft 0½ in)
Height: overall, both rotors turning	3.96 m (13 ft 0 in)
to top of main rotor head	3.45 m (11 ft 3¾ in)
Tailplane span (over endplate fins)	3.12 m (10 ft 2¾ in)
Ground clearance: tail rotor	2.00 m (6 ft 6¾ in)
fuselage	0.45 m (1 ft 5¾ in)
Skid track	2.40 m (7 ft 10½ in)

DIMENSIONS, INTERNAL:

Cabin: Length: excl cockpit	3.42 m (11 ft 2½ in)
incl cockpit	4.55 m (14 ft 11¼ in)
Max width	1.40 m (4 ft 7 in)
Max height	1.22 m (4 ft 0 in)
Floor area: excl cockpit	4.72 m² (50.8 sq ft)
total	5.43 m² (58.5 sq ft)
Volume (total)	6.8 m³ (240 cu ft)

AREAS:

Main rotor disc	95.03 m² (1,022.9 sq ft)
Tail rotor disc	3.02 m² (32.48 sq ft)

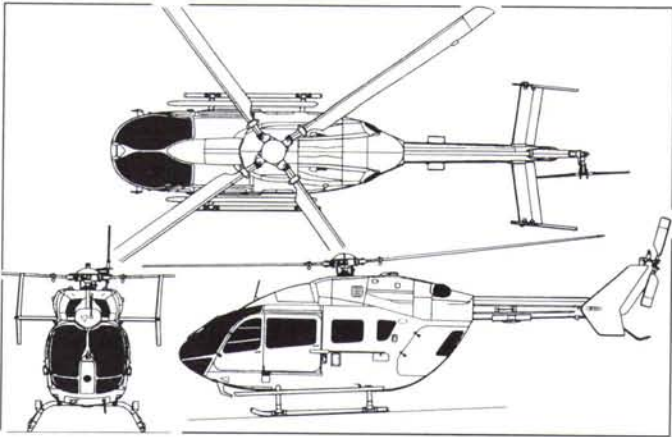
WEIGHTS AND LOADINGS:

Weight empty	1,792 kg (3,951 lb)
Max usable fuel: standard	694 kg (1,530 lb)
optional	869 kg (1,916 lb)
Max T-O weight, internal or external payload	3,585 kg (7,903 lb)
Max underslung load	1,500 kg (3,307 lb)
Max disc loading	37.7 kg/m² (7.73 lb/sq ft)
Transmission loading at max T-O weight and power	4.88 kg/kW (8.02 lb/shp)

PERFORMANCE (A: at gross weight of 2,200 kg; 4,850 lb, B: at 2,700 kg; 5,952 lb, C: at 3,000 kg; 6,614 lb, D: at 3,585 kg; 7,903 lb):

Never-exceed speed (VNE):

A, B, C	150 kt (278 km/h; 173 mph)
D	145 kt (268 km/h; 166 mph)



Eurocopter EC 145/Kawasaki BK 117C-2 (Paul Jackson)

1158931

Max cruising speed: A	138 kt (256 km/h; 159 mph)
B	137 kt (254 km/h; 158 mph)
C	136 kt (252 km/h; 156 mph)
D	133 kt (246 km/h; 153 mph)
Normal cruising speed: A	127 kt (235 km/h; 146 mph)
B	129 kt (239 km/h; 148 mph)
C	130 kt (241 km/h; 150 mph)
D	131 kt (243 km/h; 151 mph)
Max rate of climb: A	978 m (3,210 ft)/min
B	780 m (2,560 ft)/min
C	674 m (2,210 ft)/min
D	488 m (1,600 ft)/min
Service ceiling: A, B, C	5,485 m (18,000 ft)
D	5,240 m (17,200 ft)
Hovering ceiling IGE: A, B	5,485 m (18,000 ft)
C	4,695 m (15,400 ft)
D	2,925 m (9,600 ft)
Hovering ceiling OGE: A	5,485 m (18,000 ft)
B	5,120 m (16,800 ft)
C	4,345 m (14,250 ft)
D	370 m (1,215 ft)
Range at normal cruising speed, no reserves:	
standard fuel:	
B	380 n miles (705 km; 438 miles)
C	378 n miles (700 km; 435 miles)
D	367 n miles (680 km; 422 miles)
optional fuel:	
C	472 n miles (875 km; 543 miles)
D	461 n miles (855 km; 531 miles)

Endurance at 65 kt (120 km/h; 75 mph), no reserves:

standard fuel:	
B	3 h 55 min
C	3 h 50 min
D	3 h 35 min
optional fuel:	
C	4 h 50 min
D	4 h 30 min

EUROCOPTER UH-72A LAKOTA

TYPE: Light utility helicopter.

PROGRAMME: Light Utility Helicopter (LUH) programme formally launched in September 2004, with release by US Army of technical requirements in a capability development document. Resulting LUH intended to replace UH-1H Iroquois and OH-58A/C Kiowa and will not be deployed to combat theatres; majority expected to remain within continental USA, serving with regular force elements and the Army National Guard. EADS North America offered version of EC 145 (known by company as UH-145) and faced competition from AgustaWestland AB139, Bell 412EP and MD Helicopters Explorer. Civilian UH-145 demonstrator (N145UH) prepared at Grand Prairie, Texas to participate in fly-off undertaken by US Army at Fort Rucker, Alabama in early March 2006.

EADS North America is prime contractor, with American Eurocopter given responsibility for assembly and production; teaming arrangement concluded with Sikorsky (for contractor logistical support) and WestWind Technologies (systems integration, engineering and programme management support) by the end of January 2006; subsequently, Thales USA (avionics suite), Wulfsberg Electronics (navigation and communications systems), NORDAM Group (windscreen and windows) and Armor Holdings (crew and passenger seating) had all joined the EADS North America team by April 2006.

Eurocopter UH-145 announced as winning contender at the end of June 2006, at which time EADS North America received contract valued at USD43.1 million to cover initial batch of eight helicopters: US Army designation UH-72A assigned on 5 September 2006.

Objections from AgustaWestland and MD Helicopters then necessitated review of competition by US Government Accounting Office (GAO) and caused slight delay; GAO investigation completed by 24 October 2006 and rejected protests by losing contenders.

In anticipation of winning fly-off, Eurocopter had already begun production of first two helicopters, which were due for delivery to the US Army before the end of 2006, with up to 20 to follow in 2007 and increasing to 50 per year thereafter. Formal hand-over of first ('07-2001') took place on 11 December 2006, when name of Lakota (native American people) also announced. Initial production (of up to 50 helicopters) will be undertaken in Europe, with American Eurocopter facility at Columbus, Mississippi serving as assembly centre at start of programme, but gradually making transition to production of complete helicopter with exception of rotor blades; Arriel 1E2 turboshaft engine supplied by Turbomeca factory in Grand Prairie.

CUSTOMERS: US Army has total stated requirement for 322, with option on additional 30, of which 42 under contract by late 2006.

COSTS: Initial procurement contract covering eight UH-72As valued at USD43.1 million awarded June 2006. Second batch of 34 helicopters included in 31 October 2006 contract valued at USD170.6 million, which also covered supply of a training aid and support services.

Specification generally as for EC 145, except the following.

POWER PLANT: Two Turbomeca Arriel 1E2 turboshafts, each rated at 550 kW (738 shp) for take-off.

ACCOMMODATION: Two pilots and up to eight passengers.

AVIONICS: Thales responsible for avionics, which based on Meghas suite with 'glass cockpit' featuring active matrix liquid crystal displays (AMLCDs). Navigation/communications equipment by Wulfsberg Electronics includes navigation and air traffic communications, dual VHF communications transceivers, dual VHF navigation receivers with VOR, ILS and marker beacon, DME transceiver, RT-5000 wideband receiver and dual P-2000 tactical communications transceivers.

PERFORMANCE:

Never-exceed speed (VNE)	145 kt (268 km/h; 166 mph)
Hovering ceiling IGE	3,445 m (11,300 ft)
Hovering ceiling OGE	2,745 m (9,000 ft)
Range	370 n miles (685 km; 425 miles)



Demonstrator Eurocopter UH-145 (UH-72A) military utility helicopter

1040467

EUROCOPTER/HAI

EUROCOPTER/HAI

PARTICIPATING COMPANIES:

Eurocopter: see under International

HAI: see under China

New joint venture to develop 6-7 tonne light helicopter previously known as Chinese 'Z-X', now identified as EC 175 in Europe and Z-15 in China.

EUROCOPTER EC 175/HAI Z-15

Chinese name: Zhishengji-15 (Vertical take-off aircraft 15)

TYPE: Multirole medium helicopter.

PROGRAMME: Initial framework agreement of October 2004. EC 175 announced at HAI Convention in Anaheim, California, on 6 February 2005; joint (50/50), five-year development by Eurocopter and AVIC II of China launched with contract signature on 5 December 2005; first Chinese partnership with Eurocopter in which China has equal work-share status, although Eurocopter will retain technical leadership and overall control of development. Joint project office opened in Marignane January 2006; commitment of EUR200 million (USD240 million) by each partner announced March 2006. Three flying prototypes to be built: PT1 and PT3 in France and PT2 in China. First flight, in France, targeted for June 2009; European certification and production start in each country in 2011 (final assembly lines at Marignane and Harbin); service entry 2012.



Artist's impression of Eurocopter EC 175

1153727

CUSTOMERS: Market for helicopters in EC 175/Z-15 class estimated at 800 over 20-year period.

DESIGN FEATURES: Size-wise, fits into Eurocopter product line between EC 155 Dauphin and EC 225 Super Puma/Cougar. Announced features include state-of-the-art avionics; five-blade Spheriflex main rotor; high-energy-absorbing aircraft; single-pilot operation; 16-passenger capacity. Typical missions to include transport, search and rescue and police use; military variants also possible.

STRUCTURE: Chinese team responsible for landing gear, power plant, main rotor, intermediate and tail rotor gearboxes and fuel system; Eurocopter for main gearbox, tail rotor, doors and transparencies, avionics and electrical and hydraulic systems.

POWER PLANT: Pratt & Whitney Canada PT6 turboshaft.

ACCOMMODATION: One (for VFR) or two (IFR) pilots; seating for up to 16 passengers.

DIMENSIONS, EXTERNAL:

Not yet released

WEIGHTS AND LOADINGS:

Max T-O weight 6,000-7,000 kg (13,227-15,432 lb) class

PERFORMANCE (estimated):

Max level speed 150 kt (277 km/h; 172 mph)

Range approx 200 n miles (370 km; 230 miles)

EUROFIGHTER

EUROFIGHTER JAGDFLUGZEUG GMBH
Am Sölderemoos 17, D-85399 Hallbergmoos, München, Germany
Tel: (+49 811) 80 15 55
Fax: (+49 811) 80 15 57
e-mail: info@eurofighter.com
Web: www.eurofighter.com
CEO: Aloysius Rauen
EXPORT DIRECTOR: Pier-Luigi Romaguoli
VICE-PRESIDENT, COMMUNICATIONS: Wolf Dietrich Hoeveler



RAF No. 3 Squadron Eurofighter Typhoon F. Mk 2

1159311

PROGRAMME:		DEVELOPMENT MILESTONES
Requirement issued		Dec 83
Official go-ahead		23 Nov 88
First order (multinational)		22 Dec 97
First prototype material cut		May 98
Rolled out (unofficially)		mid-92
First flight		27 Mar 94
Public debut		11 Jun 95
First flight, pre-production		5 Apr 02
Production go-ahead		30 Jan 98
Certification		30 Jun 03
First flight, production		13 Feb 03
First delivery (Luftwaffe)		17 Feb 03
Entered service (multinational)		30 Jun 03

Eurofighter GmbH formed to manage EFA (European Fighter Aircraft) programme June 1986, followed shortly after by Eurojet Turbo GmbH to manage engine programme, Eurofighter GmbH is owned by Alenia (Italy), BAE Systems (UK) and EADS (formerly CASA; Spain and DASA; Germany); development workshares are 21, 33 and 46 per cent, respectively, Eurojet Turbo participants are Fiat Aviazione (Italy), ITP (Spain), MTU-München (Germany) and Rolls-Royce (UK). Radar is provided by the Euroradar consortium of BAE Systems (UK), FIAR (Italy), EADS (Germany) and ENOSA (Spain), NETMA (NATO Eurofighter and Tornado Management Agency) supervises the programme on behalf of the customer air forces.

All four participating countries agreed on 22 December 1997 to proceed with production and signed the appropriate authorisation on 30 January 1998. The aircraft was formally named Typhoon on 2 September 1998 although, initially, that title was only used for marketing outside Europe. However, on 23 July 2002, Typhoon name was formally adopted by RAF.

On 4 November 1999, (then) four partners announced impending formation of Eurofighter International (EFI) as dedicated sales organisation with target of securing half of available market for 800 combat aircraft over following 30 years. Relations with NETMA remain unchanged. First export commitment issued by Greece on 7 March 2000, but first firm order placed by Austria.

Former subsidiary marketing organisation, Eurofighter International, was disbanded in 2002. Deliveries to customer air forces began following formal type acceptance on 30 June 2003.

Began with outline staff target for common combat aircraft issued December 1983 by air chiefs of staff of France, Germany, Italy, Spain and UK; initial feasibility study launched July 1984; France withdrew July 1985, shareholdings then being readjusted to 33 per cent each to UK and Germany, 21 per cent Italy and 13 per cent Spain; project definition phase completed September 1986; definitive ESR-D (European Staff Requirement—Development) issued September 1987, giving military requirements in greater detail; definition refinement and risk reduction stage completed December 1987; main engine and weapons system development contracts signed 23 November 1988.

After various political delays were overcome, first (instrumented) production aircraft flew (in Italy) on 5 April 2002; initial 'delivery' was 'presentation' of first full production aircraft GT001/9831 to Luftwaffe at manufacturer's German plant, the aircraft not flying until 13 February 2003, following which, on 17 February, it was delivered to a Luftwaffe technical school for ground crew familiarisation. Also by 17 February, a full production (two-seat) aircraft had flown in each of the four participating countries. On 30 June 2003 Type Acceptance certificate was issued and aircraft was formally handed over to participating air arms at national ceremonies.

In December 2002, unofficial reports claimed UK was attempting to bring forward the ground attack enhancements scheduled for Tranche 3 into the second international production batch, allowing the RAF to cut back or eliminate its final batch of 88 aircraft. Statements throughout 2003 strengthened this impression and agreement on Tranche 2 had not been reached by scheduled date of end-2003. Eventually signed 17 December 2004.

Four partner air forces initially agreed to name their aircraft Eurofighter (or EF2000), using Typhoon name for export marketing. However, on 23 July 2002, RAF also adopted Typhoon during a ceremony at Farnborough Air Show. Delivery of 100th Eurofighter (BS022/ZJ931 for RAF) effected 29 September 2006.

Typhoon is participating in several fighter competitions, as detailed in the adjacent table.

No formal roll-out; DA1 and DA2 remained unfown for some 18 months after completion for exhaustive cross-checking of flight control system (FCS). First flight eventually achieved on 27 March 1994, but FCS development resulted in later aircraft flying out of sequence, DA6 being fourth to fly (31 August 1996), by which time earlier aircraft had completed 241 sorties, DA5 flew Eurofighter's 500th sortie (almost 450 hours total airborne time) on 21 October 1997; the 750th sortie (over 630 hours) was flown in June 1998 and the 1,000th in May 1999. Total 1,135 sorties and 931 hours by fourth quarter of



Eurofighter Typhoon production at Warton

1159308

EUROFIGHTER TYPHOON

Spanish Air Force designations: C.16 and CE.16
Royal Air Force designations: Typhoon T. Mk 1, T. Mk 1A and F. Mk 2
TYPE: Multirole fighter.



German Eurofighter EF2000 carrying four Paveway, two IRIS-T, four Sidewinders and three 1,000-litre tanks

1159310

1999; 1,000th hour flown February 2000. Some 90 per cent of flight envelope had been explored by April 1999.

Defensive aids subsystem development contract awarded to Euro-DASS 13 March 1992, but Germany and Spain initially declined to participate; production contract allocated June 2001. 'A' version of ECR 90 radar first flew in nose of modified BAe One-Eleven testbed (ZE433) at Bedford, 8 January 1993; 'C' version is first ECR 90 packaged to fit Eurofighter; flown in One-Eleven from July 1996. First development standard radar delivered to DASA in June 1996; flight testing (in DA5) began 24 February 1997. Radar named Captor in 2000; first production unit delivered in February 2001. Electronically-scanned Captor-E scheduled for Tranche 3 aircraft; to begin flight trials in 2007.

Major airframe fatigue test (AFT) fuselage at Ottobrunn achieved 6,000 hours in May 1995 and target of 18,000 hours (equivalent to 6,000 hours of service use) on 4 September 1998.

Production version of EJ200 engine certified 8 March 2001. Thrust vectoring nozzles for EJ200 had undergone 78 hours of bench testing by mid-2000. Study launched by ITP of Spain in 1994, using private funding. Trial system demonstrated 23° 30' vector angle and 110°/s slew rate; advantages of installation for regular use would include 3 per cent reduction in cruise drag, 7 per cent improvement in sustained turn rate, 7 per cent increase in installed thrust, 25 per cent reduction of take-off run and 3 per cent reduction of mission fuel burn.

Three production Tranches subdivided into Batches and Blocks, each of increased capability: Refer to table.

EUROFIGHTER PRODUCTION BLOCKS

Tranche 1	Batch 1	Block 1	Basic standard for training; radar; no defensive aids, Cannon, AIM-9L, AIM-120B, ASRAAM; external fuel tanks
		Block 1B/1C	Variations of the above
	Batch 2	Block 2	Full IOC. Adds IRIS-T, Initial sensor fusion (Captor, IFF and MIDS datalink); initial defensive aids (RWR/ESM, chaff/flare, basic ECM). Basic autopilot and microwave landing; basic direct voice input. Type acceptance 13 December 2004
		Block 2B	Full air-to-air and carefree handling. Type acceptance 15 December 2005
		Block 5	FOC standard. Austere air-to-ground (employed only by UK). Total sensor fusion; full defensive aids and missile approach warning; full direct voice; PIRATE (not Germany); towed radar decoy (not Germany); laser warning (UK only). Litening pod; GBU-10, GBU-16, Paveway II, AIM-120C-5
Tranche 2	Batch 3	Block 5A	Austrian two-seat
		Block 8	From 2007. New computers. Includes Austrian single-seat
		Block 8A	Unspecified
	Batch 4	Block 8B	Unspecified
		Block 10	Future Capability Package. Production Enhancement I. Additional air-to-ground weapons
Tranche 3	Batch 5	Block 10B	Unspecified
		Block 15	Meteor missile
		Block 20	Under formulation. Possible developed engine and electronically-scanned radar
	Batch 6?	Block 25	Unspecified

Trials of air-to-surface weapons intensified in 2006; several combinations flown by trials aircraft. First drop of any-surface weapon achieved 4 May 2006 by Spanish C.16-20 releasing GBU-16s.

In April 2002, industrial partners completed a 12-month study into further development of Eurofighter to maintain operational effectiveness beyond 2040. Options addressed (some previously mooted unofficially) included electronically scanned radar, two-dimensional thrust vectoring, extended range and signature reduction. These to be applicable to Tranche



Italian Eurofighter two-seat trainer

1159312

2 and 3 aircraft. Germany and UK seeking to add long-range attack capability in Tranche 3; BAE Systems announced completion in May 2002 of wind tunnel trials of conformal fuel tanks offering 25 per cent extension of range and mockup shown at Farnborough in July 2002.

CURRENT VERSIONS (general): **Single-seater:** Standard version. Known to RAF as **Typhoon F**. Mk 2 and to Spanish Air force as **C.16**. Also abbreviated to **EF2000**.

Two-seater: Combat-capable conversion trainer. Slightly reduced internal fuel capacity. Known to RAF as **Typhoon T**. Mk 1 (first 12 flying aircraft: IPA1/ZJ699 and ZJ800 to ZJ810). **T, Mk 1A** (ZJ811 and subsequent) and to Spanish Air Force as **CE.16**. Also known as **EF2000B** or **EF2000T**.

CURRENT VERSIONS (specific): **DA1/9829:** (DASA-built at Ottobrunn; airframe No. 01; Luftwaffe serial number 9829.) By road to Manching 11 May 1992; first flight, 27 March 1994, using Phase 0 software; planned transfer to Warton for handling and envelope expansion trials (wearing UK serial number ZH586) cancelled; remained at Manching.

Transferred to Getafe, Spain, 8 April 2003 and reserialled XC.16-02. First Eurofighter flight with IRIS T (dummy) AAMs 27 August 2003. Final flight December 2005; retired.

DA2/ZH588: (BAE at Warton; airframe No. 02.) First engine run 30 August 1992, first flight 6 April 1994; assigned to envelope expansion, 'carefree' handling and load trials; nine sorties to June 1994, when stood-down for FCS upgrade; reflown 17 May 1995 with Phase 2 version of flight software and made Eurofighter's world public debut (Paris, 11 June 1995, static) and UK debut (Fairford 22 July 1995, flying).

'Carefree handling' trials completed by mid-2002; DASS decoy trials.

DA3/MMX602: (Alenia at Turin/Caselle; airframe No. 04.) First with EJ200 power plants (series -01A) for engine trials (originally scheduled from March 1993 but postponed) and gun/weapon release trials. Initial flight 4 June 1995 on Phase 1 software (20° AoA and +6 g limits).

DA4/ZH590: (BAE; airframe No. 03.) First two-seat and first with full avionics (including ECR 90) for radar development, and 'carefree' handling trials. Rolled out 4 May 1994; first flight 14 March 1997; 14 sorties up to end of first phase of trials on 8 September 1997.

DASS ESM trials 2002.

DA5/9830: (DASA.) Construction begun 2 November 1992; maiden flight 24 February 1997; first with ECR 90 radar; autopilot and weapons trials. DS-X radar software standard upgraded to DS-C1 in June 1997, at which time first EJ200-03A engines fitted.

DA6/XCE.16-01: (EADS CASA at Seville.) Second two-seat; performance (including 'carefree' handling), environmental systems, MIDS integration and helmet integration trials.

First flight 31 August 1996; high-temperature trials at Morón, Spain, from 20 July 1998; trials of LCSS (see Systems) cooled aircrew clothing, June 1999; environmental trials (with DA1), including ground tests at Boscombe Down, completed May 2000. Direct voice input trials begun 2001. Refuelling trials with Spanish KC-130H Hercules mid-2002. Suffered double flame-out of 03A-standard engines on 21 November 2002 and abandoned by crew. Total 324 hours in over 340 sorties. Spanish testing resumed in April 2003 upon transfer of DA1 from Germany.

DA7: (Alenia.) Nav/com, performance and weapons integration trials. First flight 27 January 1997. First firing of AIM-9L Sidewinder 15 December 1997; first AIM-120 AMRAAM jettison two days later; first (1,000 litre) external wing tank jettison 17 June 1988.

Further eight ground testing part-airframes and five instrumented production aircraft.

IPA1/ZJ699: (UK.) Two-seat; first production Eurofighter Typhoon. Production numbers PT001/BTT1. Final assembly began 8 September 2000; delivery was due in late 2001; however, first flight postponed to 15 April 2002; first supersonic flight by a production aircraft, 26 April 2002; short lay-up after six sorties for addition of refuelling probe, flight test instrumentation and paint. Defensive aids trials. First Paveway II releases in UK announced July 2006. Planned 414 sorties to FOC.

IPA2/MMX614: (Italy.) Two-seat; PT002; air-to-surface weapon and sensor fusion trials. Final assembly began 3 November 2000. First flight 5 April 2002. Planned 301 sorties to FOC.

IPA3/9803: (Germany.) Two-seat; PT003; air-to-surface weapon integration. Rolled out 2 March 2002. First flight 8 April 2002; 100th flight 17 February 2004. Planned 408 sorties to FOC.

IPA4/C.16-20: (Spain.) Single-seat; PS001; AAM and gun trials; environmental system trials. Planned 170 sorties to FOC. First components delivered March 2003; first flight 27 February 2004 as initial production single-seat Eurofighter. Transferred to Vidsel, Sweden, for cold weather trials 9 December 2004. These completed 8 March 2005. Aircraft then to Morón, Spain, for hot weather trials, 2005.

IPA5/ZJ700: (UK.) Single-seat; PS002; air-to-air and -surface weapons trials. Planned 223 sorties to FOC. First flight 7 June 2004.

Early production aircraft:

GT001/9831: (to become 3001) (Germany.) Rolled out 14 November 2002; 'presented' to Luftwaffe 9 December 2002; first flight 13 February 2003; delivered to Air Force Technical School No. 1 at Kaufbeuren for ground training 17 February 2003.

IT001/CSX55092: (Italy.) First flight 14 February 2003. Initially assigned to EMC clearance.

BT001/ZJ800: (UK.) First flight 14 February 2003. To QinetiQ at Boscombe Down for EMC clearance.

BT005/ZJ804: First Instrumented Service Production Aircraft. First flight 11 May 2004.

ST001/CE.16-01: (Spain.) First flight 17 February 2003.

GS001/3006: (Germany.) First single-seat. Rolled out 14 July 2004. To JG 73 4 July 2005.

GS002/9839: (to become 3007) (Germany.) Second single-seat and first non-



RAF Eurofighter Typhoon equipped with six Paveway II LGBs, two Sidewinders and one 1,000-litre tank

1159309



Eurofighter EF2000 two-seat version in Spanish service

1159313

instrumented aircraft to fly, on 22 October 2004. To TSLW 1, Kaufbeuren 14 Feb 2005.
GS003/3008: To JG 73 24 June 2005.

GS004/3009: To JG 73 8 April 2005 as first single-seat in service.

IS001/ISPA2/CSX7235: (Italy). First single-seat; second Instrumented Service Production Aircraft, First flight 9 July 2004.

BS001/ZJ910: (UK). First single-seat.

SS001/C.16-20: (Spain). First single-seat. Delivered 29 December 2004.

CUSTOMERS: Originally declared requirements for 765 (UK and Germany 250 each; Italy 165 and Spain 100). In January 1994, Spain announced firm requirement for 87; Germany revised needs to 180 (including at least 40 fighter-bombers post-2012) under January 1996 work-share agreement. Final total is 620 aircraft, including 1,382 engines; plus options on 90 and 183, respectively (see accompanying table). MoUs 6 and 7 (production and logistical support) of 3 December 1997 and Production Investment contract of 10 December followed on 22 December 1997 by political agreement of all four nations to fund production phase.

Production contract (Supplement 1) for all 620 aircraft (plus 90 options) signed 30 January 1998; Supplement 2 agreement of 18 September 1998 authorised first 148 of these on fixed-price terms, together with 363 engines. UK parliament told in early 2002 that all four participating countries were reviewing aircraft delivery schedule.

Deliveries to air forces to have begun in June 2002 with RAF and Italy; this delayed one year to 30 June 2003, at which time 28 aircraft (eight German, five Italian, four Spanish and 11 UK) were earmarked for delivery before end of 2003, this not being achieved. Delivery of 50th effected 29 June 2005 and 89 delivered by July 2006. Hours by this time totalled 14,000, including 4,500 of testing.

RAF acceptance of BT001/ZJ800 rescheduled to December 2002, but not effected until 30 June 2003. First RAF unit, under Wg Cdr David Chan, is Operational Evaluation Unit (OEU, also known as No. 17 (Reserve) Squadron) at BAE Warton, where first 16 pilots converted using four aircraft in 1,300 flying hours; formation date of September 2002 delayed to 1 July 2003; first public showing of No. 17 Squadron aircraft (ZJ802 'AB') at Royal International Air Tattoo, Fairford, 18–20 July 2003 (had first flown only on 16th). RAF aircraft issued with Release to Service on 13 May 2004, allowing operational test and OCU syllabus validation flying to begin. Coningsby formally received OEU on 19 May 2005 (previously scheduled for January 2004) and formed No. 29 (Reserve) Squadron as an OCU, these with four and five aircraft, respectively (those of No. 29 being delivered from April 2004 onwards, before official formation and transfer of unit to Coningsby on 1 July 2005). Coningsby also to host two operational squadrons: No. 3 formed 31 March 2006 and No. 11 in March 2007. Deliveries of Tranche 2 aircraft to No. 6 Squadron at Leuchars begin 2008, two more units to follow at that base, while establishment of two at Leeming remains uncertain. First flight of Typhoon in No. 29 Squadron markings undertaken at Warton on 20 May 2004. First for No. 11 Squadron (ZJ931) delivered Coningsby on 9 October 2006. First of seven combat squadrons were to have been air defence tasked; remainder to comprise three air defence, two multirole and one offensive support. However, by 2003, RAF was seeking all seven in multirole task by 2011, with Tranche 1 aircraft relegated to training and trials.

RAF announced in May 2000 that no ammunition would be procured for Eurofighter's cannon, despite installation of Mauser in Tranche 1 aircraft. Decision reversed in 2006. Rafael Litening III targeting pods selected 2005.

German acceptance of squadron aircraft (all two-seat) began 4 August 2003; first production single-seat (GS002/3007) handed over 14 February and delivered to ground training school on 24 February 2005; and first to JG 73 (3009) on 8 April 2005. Air defence wing JG 73 at Laage began formal conversion 1 October 2003 under auspices of manufacturer at Manching; initial instructor training completed 2 April 2004; unit moved with five aircraft to Laage on 30 April 2004; received first IRIS-T missiles 5 December 2005.



German Eurofighter trainer of JG 73

1159314

Second wing is JG 74 at Neuberg to which first aircraft delivered on 25 July 2006; third wing is attack unit JG 31 at Nörvenich (from 2007); fourth is air defence JG 71 at Wittmund (from 2009); fifth is JG 33 at Büchel (2012–2015) in attack role; final German delivery in 2014, but further two squadrons (single- or two-seat to be decided) may be obtained for air-to-ground operations.

Italian re-equipment begins with 4° Stormo at Grosseto (9° Gruppo and 20° Gruppo), other bases being Cameri (53° Stormo) and Trapani (37° Stormo). Initial acceptance (IT001) for technical training at Cameri 20 February 2004. First squadron aircraft (IT002/MM55093) accepted by 4° Stormo on 16 March 2004; first air force assigned (second built) single-seat (MM7270) delivered 19 April 2005. Assigned QRA duties from 16 December 2005.

Deliveries to Spanish Air Force began 5 September 2003 upon hand-over of first aircraft, CE.16-01, although initial pilot training continued with manufacturer at Getafe until April 2004; formal acceptance ceremony on 9 October 2003. First (OCU) squadron is Escuadron 113 of Ala 11 at Morón de la Frontera, to where initial three aircraft were delivered on 27 May 2004. Single-seat deliveries began 29 December 2004. Escuadron 111 formed 2006; 112 to follow in 2009; while 141 and 142 to be based at Albacete with Ala 14, forming 2012 and 2015, respectively.

Other details in accompanying table.

Export orders also being solicited; various programmes, requirements and requests for proposals detailed separately. First firm order from Austria; deliveries scheduled from 1 June 2007. Eurofighter predicts export of 400 Typhoons between 2005 and 2030, worth in excess of GBP35 billion (2000).

Contract for Eurofighter ground support system signed 24 May 2000. UK has four training rigs, numbered ZJ695 to ZJ698. Aircrew Synthetic Training Aids programme contract, worth EUR1.07 billion, signed 27 April 2001, including 18 full mission simulators and nine cockpit trainers, deliverable from March 2004 to all four participants.

COSTS: Development EUR18 billion; production (620 aircraft) EUR36 billion at 2004 prices (2006). UK unit cost officially GBP49.1 million in 2004 but increased without clarification to GBP64.8 million, which figure is disputed by Eurofighter. UK Tranche 1 unit cost GBP45.45 million; global Tranche 2 averaged GBP40 million when awarded.

DESIGN FEATURES: Agile fighter; subsonic instability exceeds 35 per cent (as achieved by Grumman X-29 research aircraft). Collaborative design by BAE, DASA, Alenia and EADS CASA, incorporating some design and technology (including low detectability) from BAe EAP programme. No official requirement for thrust vectoring (TV), supercruise or high order of 'stealthiness'; however, TV nozzle for Eurofighter is under private development; supercruise was 'inadvertently' demonstrated at high altitude in 1997; and RAF has confirmed that aircraft meets low-observables specification.

Low-wing, low-aspect ratio tailless delta with 53° leading-edge sweepback; underfuselage box with side-by-side engine air intakes, each with fixed upper wedge/ramp and vari-cowl (variable position lower cowl lip) with Dowty actuators.

Wing section NACA66 (mod); taper ratio 2.15; dihedral 1°. Foreplane section RAE 104.

Intended service life, 6,000 hours or 25 years. Integrated structural health-and-usage monitoring system (first in any combat aircraft) calculates structural fatigue at 20 positions on the airframe 16 times per second during flight. Maintainability features include 10 mmh/th and single engine change by four engineers in 45 minutes. Operational turn-round by six ground crew in 25 minutes. Germany, and possibly UK, will contract-out maintenance on 'power by the hour' arrangement with private industry.

FLYING CONTROLS: Two-segment automatic slats on wing leading-edges, inboard and outboard flaperons on trailing-edges; all-moving foreplanes below windscreen; rudder; hydraulically actuated airbrake aft of canopy, forming part of dorsal spine; Liebherr primary flight control actuators. Full-authority quadruplex ACT (active control technology) digital fly-by-wire flight control system (team leader was DASA; Bodenseewerk and ENOSA flight control computer) combines with mission adaptive configuring and aircraft's instability in pitch to provide required 'carefree' handling, gust alleviation and high sustained manoeuvrability throughout flight envelope; pitch control provided by symmetric operation of foreplanes and wing flaperons; roll control primarily by differential operation of flaperons; yaw control by rudder. Cross-feeds between controls to optimise performance and handling qualities provide artificial longitudinal stability; yaw control via rudder; no manual reversion.

STRUCTURE: Fuselage, wings (including inboard flaperons), wing-fuselage fairings, fin and rudder mainly of CFC (carbon fibre composites) except for foreplanes, outboard flaperons and exhaust nozzle fairings (titanium); nose radome and fin tip (GFRP); leading-edge slats, wingtip pods, fin base, fin leading-edge, rudder trailing-edge, cockpit side strake and canopy-to-airbrake fairing (aluminium-lithium alloy); and canopy surround (aluminium). CFC constitutes 70 per cent of surface area, with metal 15 per cent, GFRP 12 per cent and other materials 3 per cent.

Individual wing composed of 438 kg (966 lb) carbon fibre, 174 kg (384 lb) aluminium, 179 kg (395 lb) titanium, 33 kg (73 lb) fasteners, 17 kg (37 lb) miscellaneous items and 24 kg (53 lb) tip pod, while installations and equipment add further 120 kg (265 lb) and 154 kg (340 lb), respectively.



Single-seat Eurofighter in German service (Jamie Hunter)

1194935

Manufacture includes such advanced techniques as superplastic forming and diffusion bonding; EADS CASA-led joint structures team. On development aircraft (only) UK responsible for front fuselage, foreplanes, starboard leading-edge slats and flaperons; Germany the centre-fuselage and fin, Italy the port wing, port leading-edge and flaperons, and stages 2 and 3 of rear fuselage; Spain the rear fuselage stage 1; and Spain and UK the starboard wing; no duplication of tooling.

Work-share on production aircraft involves UK for front fuselage, canards, windscreen, canopy, dorsal fairing inboard flaperons, fin and rear fuselage stage 1; Germany for centre-fuselage; Italy for port wing, outboard flaperons and rear fuselage stages 2 and 3; and Spain for starboard wing and leading-edge slats. Assembly at Caselle (Italy), Getafe (Spain), Manching (Germany) and Warton (UK).

LANDING GEAR: Dowty Aerospace retractable tricycle type with SICAMB mainwheels and Magnaghi/OMA nose gear; Dunlop Aviation wheels, brakes and braking system; Ultra Electronics landing gear computer. Single-wheel main units retract inward into fuselage; nose-wheel unit forward. Nose-wheel steering is subfunction of DFCS. Tyre sizes 28x9.5R15 main; 18x7.75R6 nose. Elektro Metall braking parachute at base of fin.

POWER PLANT: Two Eurojet EJ200 advanced technology turbofans (each of approximately 60 kN; 13,490 lb st dry and 90 kN; 20,250 lb nominal thrust with afterburning), mounted side by side in rear fuselage with ventral intakes. EJ200-01A initially: -1C for early flight tests; -03A first flown June 1997 (DA5); -03B followed in late 1998; and 03Z in December 1999. Staged EJ200 improvements available (but not funded) to 103 kN (23,155 lb st) (designated EJ 230) and then 117 kN (26,300 lb st). MTU FADEC. Lucas Aerospace fuel management system; Aeroquip GmbH fuel ducts; Autoflug sensors; Teldix flowmeters; VDO computer and gauges; Smiths fuel measurement system. First two development aircraft originally powered by two Turbo-Union RB199-122 (Mk 104E) afterburning turbofans (each more than 71.2 kN; 16,000 lb st). Both were retrofitted with EJ200s in 1998.

Internal fuel capacity classified, but believed to total approximately 5,700 litres (1,506 US gallons; 1,254 Imp gallons) in two fuselage tanks and two integral wing tanks. Two-seat trainer lacks forward transfer tank, but partly offsets loss of capacity with auxiliary tank in the enlarged spine. Pressure refuelling point below fuselage, immediately behind air intake. Provision for in-flight refuelling and up to three suspended, external fuel tanks: two 1,000 litre (264 US gallon; 220 Imp gallon) or 2,000 litre (528 US gallon; 440 Imp gallon) underwing, plus one 1,000 litre (264 US gallon; 220 Imp gallon) centreline tank. Only the smaller tanks are rated for supersonic flight.

In early 1998, UK was reported to be designing upper fuselage conformal tanks to increase combat radius to 1,500 n miles (2,778 km; 1,726 miles); work subcontracted to GKN Engage in Australia. Wind tunnel trials of conformal tanks completed May 2002, size 1,500 litres (396 US gallons; 330 Imp gallons) each, providing for additional total of 2,400 kg (5,291 lb) of fuel, for 25 per cent range increase. Conformal tanks can be installed or removed in 75 minutes. Tranche 2 aircraft have structural and piping modifications to accept conformal tanks.

ACCOMMODATION: Pilot(s) on Martin-Baker Mk 16A zero/zero ejection seat(s). Single-piece Aerospace Composite windscreen and single-piece, rear-hinged canopy on both versions. Optional liquid-cooled vest for pilot. Helmet-mounted display. Anti-g trousers augmented

by pressure breathing system. Two equipment/baggage stowage bays, each 0.01 m³ (0.35 cu ft), above air intakes, port and starboard.

SYSTEMS: Responsibility for systems delegated to Eurofighter GmbH; participants are UK for electrics, Spain for environmental control and Germany for hydraulics.

Flight control system combines stability and control augmentation; good handling characteristics; high agility; and carefree handling, while incorporating safety features such as low-speed automatic recovery, emergency g override, g onset limitation, disorientation recovery capability and automatic reversion. System is controlled by four computers and features primary and secondary actuation. FCS features automatic revision through various back-up modes and is integrated with other systems through avionics (STANAG 3910) and utilities control (STANAG 3838) databusses. FCS software updated to Phase 2 in late 1995; Phase 2A 'carefree' handling throughout the subsonic flight envelope, including 25° AoA and over +6 g (cleared by DA2 in January 1998); Phase 2B allows carriage of heavy stores and comprises 2B1 (flown April 1999) for 28° AoA and +7.25 g; and 2B2 for 30-35° and 9 g (first flown 7 July 2000). Phase 3 is IOC standard in 2001 (9 g envelope), DA2, DA4 and DA6 receiving Phase 3R1 in that year; Phase 4 covers air-to-surface weapons; and full combat capability Phase 5. FCS incorporates auto-recovery mode ('panic button') for immediate return to straight-and-level flight in emergency. Ada language, apart from time-critical subroutines in Assembler.

Electrical system has Lucas Aerospace as leading supplier and is designed to minimise risk of total power loss by using high level of redundancy and by system positioning. Engine start, systems test, avionics activation and alignment, need no external power. Elements include ZF accessories drive gearbox, two AC and two DC engine-driven Hamilton Sundstrand generators, Honeywell APU in forward port wingroot, Varta battery in corresponding starboard position, two Ferranti Technologies transformer/rectifier units and power converter from same company.

Environmental control system (ECS), with Normalair Garrett as leading supplier, provides conditioned and partly conditioned air to cockpit canopy seal, anti- and de-misting, pilot's anti-g clothing, radar, FLIR, avionics and general equipment. Main oxygen provided by molecular sieve generation system (MSOGS). Precooler (at base of fin), heat exchanger, cold air unit and MSOG all located in aircraft's spine. Liquid cooling subsystem (LCSS) connects aircrew vest to ECS.

Hydraulic system (Magnaghi as leading supplier) comprises two independent circuits supplying power to flight control system (Dowty Boulton Paul actuators), landing gear (including nose-wheel steering and brakes), port and starboard utilities, gun, canopy, airbrake and refuelling probe.

Utilities control system is integrated within overall system architecture and provides for continuous monitoring and fault detection, comprising front computer, fuel computer, secondary power system computer, landing gear computer and maintenance data panel. Integrated monitoring and recording system constantly checks status of all other systems, airframe and engine, to provide rapid, onboard fault diagnosis; functions include crash-survivable memory, bulk storage device, video-voice recording, mission data loading and portable data store, maintenance data panel, portable maintenance data store and air-to-ground relay of data.

EUROFIGHTER ORDERS

Block	Austria		Germany		Italy		Spain		UK		Summary		Total
	S	T	S	T	S	T	S	T	S	T	S	T	
IPA				1		1	1		1	1	2	3	5
1				8		6				12		31	31 ¹
2			13	1	8	1	5	1	17	1	43	4	47
2B			8	4	6	1	4	1	11	3	29	9	38
5			5	2	4	1	1	1	6	1	16	5	21
5A											6		6
Tranche 1 ²	6		26	16	18	10	11	8	35	18	96	52	148
Tranche 2 ³	12		60	10	44	3	28	6	85	6	229	25	254
Tranche 3 ⁴			61	7	44	2	33	1	75	13	213	23	236
Totals	18		147	33	106	15	72	15	195	37	538	100	638

Notes: S is single-seat; T is two-seat

German aircraft: numbered 9803 (IPA3), then 3001 onwards for both single- and two-seat versions; temporary flight test and evaluation serial numbers from 9831 onwards. RAF Tranche 1 are ZJ700 and ZJ910 to ZJ945 for single-seat, and ZJ699 and ZJ800 to ZJ815 for 17 of two-seat aircraft. Italian two-seat begin MM55092 to '097, then 55128, while two-seat MM7235, then MM7270 onwards. Spanish two-seat are CE.16-01 to '15; single-seat from C.16-20 onwards. Austrian aircraft (all single-seat) coded 7L-WA to 7L-WR. Conversion of 15 early aircraft to Block 5 in 'R2' retrofit programme began in November 2006, with priority to Block 2B aircraft

¹ Including one (17th from international production) for static testing, designated TR001

² Plus 363 engines and 147 radars

³ Plus 519 engines and 236 radars

⁴ Plus 500 engines and 236 radars

EUROFIGHTER TYPHOON EXPORT ORDERS AND PROSPECTS

Nation	Requirement	Timeframe	Status
Requests for proposals (RFP)			
Austria	18		Tenders for 24 fighters invited 10 October 2001. Proposals received from Eurofighter, F-16 and Gripen 23 January 2002. Selection announced 2 July 2002, but suspended 9 September 2002 following fall of government. Competition reopened 28 February 2003; parliamentary decision 11 June 2003; contract signed 1 July 2003; presidential approval given 21 August 2003 and contract became effective 22 August for 18 single-seat aircraft to be delivered in 2007 (four) and 2008 (14). Initial acceptance due 1 June 2007.
Greece	60 plus 30 option		Selection confirmed April 1999. EF Office Athens opened July 1999. Intentions confirmed March 2000. Order delayed by financial constraints. April 2001 and competition re-opened in 2004.
South Korea	40	Deliveries 2004–2007	EF Office Seoul opened April 1998. RFP received June 1999. Proposal submitted 8 September 1999. Flight evaluation expected early 2000. Final RFP submitted 28 June 2000. Flight Evaluation Team December 2000.
Norway	48–60	Deliveries 2010	EF Office Oslo opened March 1999. RFP received 15 February 1999. Proposal submitted 1 June 1999. Offsets proposal submitted 1 December 1999. Competition suspended 2000, but industrial participation agreement signed 28 January 2003 and several Norwegian companies received subcontracts. Response to proposals submitted by Eurofighter in March 2006. Early discussions under way in 1999. Commitment to purchase announced 21 December 2005. Initial 24 from RAF production.
Saudi Arabia	possible 72	Decision after 2000	
Requests for information (RFI)			
Australia	60	Decision after 2000	Discussions under way in 1999. F-35 JSF selected. RFI received June 1999. RFI response September 1999. Gripen selected. Request expected 2006.
Czech Republic	Possible 36	Long-term requirement	Request 2006. RFI received June 1999. RFI response October 1999.
India			RFI received June 1999. RFI response October 1999.
Japan			RFI received June 1999. RFI response July 1999.
Netherlands	60–70	Decision 2005. Deliveries 2010	F-16 selected. RFI response submitted late 1999. Evaluation late 2001. Shortlisted 10 October 2003 (with Rafale and F-15). Flight evaluation July 2004. Eliminated April 2005.
Poland	60	Long-term requirement	
Singapore	20		

AVIONICS: BAE Systems has overall team leadership for avionics development and integration. All avionics, flight control and utilities control systems integrated through STANAG 3910 databus highways with appropriate redundancy levels, using fibre optics and microprocessors. Some functions activated by direct voice input, with 100 word vocabulary.

Comms: Rohde & Schwarz or Elmer VHF/UHF communications, both secure and non-secure. BAE video and voice recorder. EADS and Cossor IFF; BAE antennas.

Radar: Euroradar ECR 90 Captor coherent, multimode, pulse-Doppler radar.

Flight: Smiths mission data loader and radar altimeter. Litton laser INS/GPS; Marconi SpA microwave landing system, plus ILS and differential global navigation satellite system; BAE Systems TERPROM and ground proximity warning; Tacan; provision for terrain reference navigation; Elmer SpA crash survival memory unit.

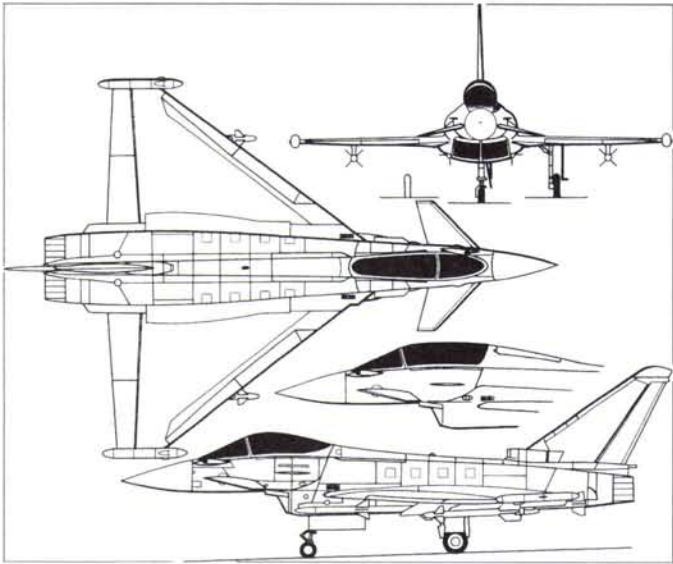
Instrumentation: Special attention given to reducing pilot workload. New cockpit techniques simplify safe and effective operation to limits of flight envelope while monitoring and managing aircraft and its operational systems, and detecting/identifying/attacking desired targets while remaining safe from enemy defences. This achieved through high level of system integration and automation, including HOTAS controls; BAE wide-angle (30° azimuth; 25° elevation) HUD able to display, in addition to other symbology, FLIR pictures from PIRATE sensor mounted externally to port side of cockpit; helmet-mounted sight (HMS), with helmet tracking system and Smiths Aerospace direct voice input (DVI), with 200-word vocabulary, for appropriate functions; and three Smiths Industries multifunction head-down colour CRT displays (MHDD) and Smiths glareshield standby displays. EADS, EDS Defence and CANAVA digital map generator; Teldix cockpit interface unit.

Mission: Alenia and Computing Devices nav/attack computers. Eurofirst (FIAR consortium) PIRATE (Passive Infra-Red Airborne Tracking Equipment) port side of windscreen. Secure MIDS datalink. (UK requirement for MIDS reconfirmed in November 2003.) RAF aircraft to have optional reconnaissance capability with a long-range electro-optical pod, for which SR(A) 1368 was issued in 1995.

Self-defence: Advanced integrated defensive aids subsystem (DASS), contracted to Euro-DASS consortium, led by BAE Systems and including Indra (Spain) and Elettronica (Italy); includes RWR and active jamming pod at each wingtip, laser warning receiver (each side, adjacent to windscreen), missile approach warning (wing leading-edges, inboard, and at rear base of fin), Elettronica Aster/GAMESA/CelsiusTech expendables (flares in flap actuator fairings; chaff in aileron actuator fairings) and towed radar decoys. (Germany initially did not join Euro-DASS, but is now to adopt standard equipment, with contract awarded October 2001). Two BAE Systems radar decoys in the starboard wingtip pod, each on a 100 m (320 ft) fibre optic cable. Italy considering Cross Eye ECM system as alternative to towed decoy. Spain also declined to join Euro-DASS, but is now participating; UK and Spain are only nations to have LWR. Initial contract for 103 systems placed June 2001; to be augmented by German requirement and addition of EADS to consortium. Saab Avitronics BOL 510 countermeasures dispensers in all Tranche 2 aircraft, including Austria.

EQUIPMENT: Hella lighting; Logic anti-collision beacons.

ARMAMENT: Total of 13 external stores stations: five (including one wet) under fuselage and four (including one wet) under each wing. Internally mounted 27 mm Mauser gun on starboard side with 150 rounds.



Eurofighter Typhoon with scrap view of two-seat version (Paul Jackson) 1159817

Planned weapons (with maximum load in parentheses) include:

Air-to-air: Meteor (six), AIM-120 AMRAAM (six), ERAAM (six), FMRAAM (six), AIM-9L Sidewinder (six), ASRAAM (six) and IRIS-T (six).

Air-to-air surface: ALARM (six), Penguin (four), Harpoon (four), Brimstone (18), Taurus, Storm Shadow, GBU-10 (four), GBU-16 (four), Paveway III (three), CRV-7 (four pods of 19 rockets each), 500 lb bombs (12) and reduced quantity of larger weapons up to 2,000 lb Mk 84 (four).

Typical weapon combinations for specific roles could include the following:

Air superiority: Six BVRAAMs, two SRAAMs, internal cannon, plus two 2,000 litre and one 1,000 litre external fuel tanks.

Interdictor/Strike: Two cruise missiles; four BVRAAMs, internal cannon plus two 2,000 litre and one 1,000 litre tanks.

Defence suppression: Six ARMs, four BVRAAMs, two SRAAMs, internal cannon and centreline 1,000 litre tank.

Multirole: Two Paveway LGBs, two ARMs, three BVRAAMs, two SRAAMs, internal cannon, laser designation pod and two 2,000 litre and one 1,000 litre tanks.
Close air support: Eighteen Brimstones, four BVRAAMs, two SRAAMs, internal cannon and one 1,000 litre centreline tank.
Maritime attack: Six ASMs, four BVRAAMs, two SRAAMs, internal cannon and one 1,000 litre centreline tank.
Phased introduction of weapons (as envisaged before final determination of Tranche 2) is shown in an accompanying table.

DIMENSIONS, EXTERNAL:

Wing span over ECM pods	11.28 m (37 ft 0 in)
Wing aspect ratio	2.5
Length: Fuselage	14.89 m (48 ft 10¼ in)
overall	15.96 m (52 ft 4¼ in)
Height overall	5.28 m (17 ft 4 in)
Wheelbase	4.07 m (13 ft 4¼ in)

AREAS:

Wings, gross	51.2 m ² (551.1 sq ft)
Foreplanes (total)	2.40 m ² (25.83 sq ft)

WEIGHTS AND LOADINGS (approx):

Weight empty	11,150 kg (24,582 lb)
Internal fuel load	4,500 kg (9,920 lb)
External stores load (weapons and/or fuel):	
normal	6,500 kg (14,330 lb)
overload	7,500 kg (16,535 lb)

Max T-O weight: interceptor	16,000 kg (35,274 lb)
attack	21,000 kg (46,297 lb)
overload	23,500 kg (51,809 lb)
Max wing loading: interceptor	312.5 kg/m ² (64.01 lb/sq ft)
attack	410.2 kg/m ² (84.01 lb/sq ft)
overload	459.0 kg/m ² (94.01 lb/sq ft)
Max power loading: interceptor	89 kg/kN (0.87 lb/lb st)
attack	117 kg/kN (1.14 lb/lb st)
overload	130 kg/kN (1.28 lb/lb st)

PERFORMANCE (approx):

Acceleration at low level, 200 kt to M1.0	30 s
Max level speed	M2.0
Time to 10,670 m (35,000 ft)/M1.5	up to 2 min 30 s
Service ceiling	16,765 m (55,000 ft)
Runway requirement	700 m (2,300 ft)
T-O run, air combat mission	300 m (985 ft)
Combat radius, single-seat:	
ground attack, lo-lo-lo	325 n miles (601 km; 374 miles)
ground attack, hi-lo-hi with three LGBs, designator pod and seven AAMs	750 n miles (1,389 km; 863 miles)
air defence with 3 hour CAP	100 n miles (185 km; 115 miles)
air defence with 10 minute loiter	750 n miles (1,389 km; 863 miles)
g limits with full internal fuel and four AIM-120s	+9/-3

EUROFIGHTER TYPHOON WEAPONS INTEGRATION
(as envisaged before Tranche 2 agreement)

Type	Mission	Manufacturer	Features	Max load	Tranche 1 IOC/FOC	Tranche 2 EOC 1	Tranche 2 EOC 2
27 mm cannon	Short range defence	Mauser	Internally mounted, 150 rounds linkless system	1	X		
Meteor	Beyond Visual Range Air-to-Air Missile (BVRAAM)	EADS, MBDA, Saab	Ramjet propulsion Active radar seeker	6			X
AIM-120A/B AMRAAM	Advanced Medium Range AAM	Raytheon	Active radar seeker	6	X		
AIM-120C 5 AMRAAM	Advanced Medium Range AAM	Raytheon	Active radar seeker	6			X
ERAAM	Extended Range AAM	Raytheon	Dual pulse rocket motor	6	superseded by METEOR		
FMRAAM	Future Medium Range AAM	Raytheon	Liquid fuel ramjet propulsion	6	superseded by METEOR		
AIM-9L/I AIM-9L/I-1	Short range AAM	Raytheon, Ford Aerospace, Bodenseewerkgerätetechnik (BGT)		6	X		
ASRAAM	Advanced Short Range AAM	MBDA	Focal-plane array seeker	6	X		
IRIS-T	Advanced Short Range AAM	BGT	Infrared imaging seeker Thrust vector control	4 (option for 6)	X	X	
ALARM	Anti-radiation Missile	MBDA	Loiter capability	(6) currently are only 4 planned in Tranche 2		?	X
Penguin	Anti-ship Missile	Kongsberg Defence & Aerospace	Mk 3 version range 50 km	4			
Harpoon	Anti-ship Missile	Boeing	Low level flight, active radar seeker	4			
Brimstone	Anti-tank Missile	MBDA	Millimetric wave seeker	(18) currently are only 6 planned in Tranche 2			X
Taurus	Cruise Missile	EADS/Celsius/Bofors Missiles	Terrain-following, range 150-350 km	2			X
Storm Shadow	Cruise Missile	MBDA	Terprom terrain-following, range 350+ km	2			X
Paveway II (UK), GBU-10/16	Laser Guided bomb	Portsmouth Aviation Raytheon	Mk 83 (GBU 16)/Mk 84 (GBU 10) Mk 13/20 (PWII UK) bomb with laser guidance	(4) up to 5 (2000 lbs bombs) 7 (1000 lbs bombs) are planned depending on LDP position	X PW II initial capability X GBU 10/16	X PW II full capability	
Enhanced Paveway II (UK) GBU 32 JDAM	GPS and Laser Guided bomb	Boeing	Mk 83 bomb	5		X	
Lightning	GPS Guided bomb	Zeiss		1		X partially	full
Paveway III (UK), GBU 24	Laser Designator Pod Laser Guided bomb	Raytheon	Mk 84/BLU 109 bombs with advanced laser guidance	(3) up to 5 are planned depending on LDP position			X
BL755 Bombs 500-2000 lb	Cluster bomb Unguided bombs	Hunting Engineering	147 bomblets	6	(12) up to 5 (2000 lbs) 7 (1000 lbs) are possible		
Rockets CRV-7	Unguided rockets	Bristol Aerospace, Canada	19 rockets per pod	4			

Notes: Introduction indicated by 'X'. EOC = enhanced operational capability

EUROTILT

EUROPEAN TILTROTOR PROGRAMME

PARTICIPATING COMPANIES

AgustaWestland: Italy/UK

Eurocopter: International

TYPE: Multimission tiltrotor.

PROGRAMME: Beginning in 1987, the European Commission sponsored feasibility and definition studies for a tiltrotor transport, then known as EuroFAR.
By 1999, 33 companies from nine European countries had joined with Eurocopter to apply for EC funding, initially to build a test rig for a proposed 10,000 kg (22,046 lb), 12/19-seat tiltrotor, provisionally known as Eurotilt.
Meanwhile, in July 1999, Agusta announced the 10-tonne, 20-seat Erica Tiltrotor and was seeking €90 million of funding from EU's 5th Framework research programme to build a ground test vehicle (GTV).



AgustaWestland concept for a European tiltrotor

1151731

In October 1999, European Commission rejected separate funding of competing European tiltrotors and urged merger of Erica with Eurotilt.

Common research project, known as 2Gether (second-generation European tilting highly efficient rotorcraft), submitted to European Commission on 31 March 2000 by Eurocopter, Westland and Agusta (since merged as AgustaWestland).

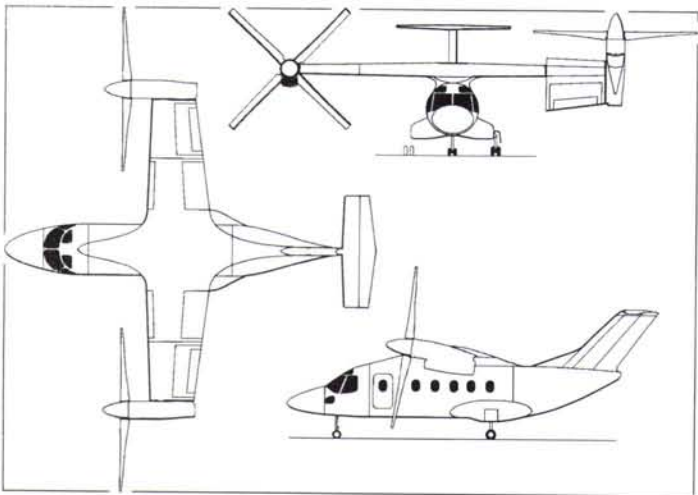
European Commission rejected 2Gether as too costly and insufficiently innovative. New development proposal submitted in March 2001; cost €40 million to €60 million, with industry providing half; features tilting outer wing, as proposed by Agusta; early research devoted to overcoming additional technical difficulties of this configuration; flight demonstration could begin in 2007–08. Study team also to include Mecaer and Teleavio of Italy; Gamesa and Sener of Spain; UK's FHL; ZF of Germany; ONERA, DLR, NLR and CIRA research institutes; Israel Aircraft Industries; and Pratt & Whitney Canada. These joined by Flight Science and Technology Laboratory at Liverpool University, UK, which inaugurated in June 2001 a flight simulator to be used in developing a control system for Eurocopter's Eurotilt submission.

Various research efforts merged into RHILP (Rotorcraft Handling qualities, Interaction and Load Prediction) project, combining Eurocopter (in France) and Eurocopter Deutschland, plus research organisations CIRA (Italy), DLR (Germany), NLR (Netherlands), ONERA (France) and University of Liverpool (UK). Three year evaluation and risk-minimisation project began March 2000 and so far embraces four work packages: WP1 for handling qualities definition, employing moving base simulator at Liverpool (first four with Bell XV-15 parameters, but progressing to Eurotilt in August 2002); WP2 analysing specific flight phenomena using 1:7 scale model at Eurocopter, Marignane; WP3 for loads alleviation; and WP4 use of Marignane's SPHERE simulator for piloted simulation tests. RHILP is only one of several Critical Technology Projects envisaged up to 2005 and its results will be incorporated in HOST flight mechanics software configured to represent Eurotilt.

By 2003, AgustaWestland Erica had evolved with smaller, but highly twisted four-blade proprotors of 7.4 m (24 ft) diameter, enabling the aircraft to take-off and land in aeroplane mode. This rotor design is optimised for speeds up to 350 kt (648 km/h; 403 mph), compared with 275 kt (509 km/h; 316 mph) for current tiltrotors. Performance and handling will be further enhanced by allowing the outboard wing panels to be tilted independently of the engine/proprotor pods at their tips, with the related benefits of a wider transition corridor

GAP was established in November 2005 by Farnborough Aircraft Corporation Ltd of the UK (FACL, which see) and Gulf Aircraft Maintenance Corporation (GAMCO) and simultaneously launched the Kestrel JP100 business turboprop at the Dubai Air Show. While the aircraft then shown in documents strongly resembled the AIR Epic LT, a legal case opened in January 2005 revealed that AIR and the UK-based FACL had entered into a secret agreement in September 2003 under which AIR was to assist with design, development, construction and certification of the slightly larger Farnborough F1. FACL engineers worked in the US, the 2006 dispute being based around the contribution of this team to the final Epic LT and F1 configurations.

Pending resolution of this dispute, FACL was said in January 2006 to have suspended the agreement with GAMCO while remaining in contact. Following arbitration in May 2006, AIR



Agusta Erica; current studies are based on the tilting outboard wing (independent of proprotor angle) envisaged by this design. Prop rotation (viewed from rear) is port, anticlockwise; starboard, clockwise, producing an 'upwards past the fuselage' airflow in forward flight (Paul Jackson)

1151697

GAP

GULF AIRCRAFT PARTNERSHIP

Building 304a, Cody Technology Park, Farnborough, Hampshire GU14 0LS, UK
Tel: (+44) 1753 74 01 00
Fax: (+44) 1753 71 43 99

PO Box 46450, Abu Dhabi, United Arab Emirates
Tel: (+971 2) 575 75 55
Fax: (+971 2) 575 72 63
e-mail: info@gulfaircraft.com
Web: www.gulfaircraft.com

GAP was established in November 2005 by Farnborough Aircraft Corporation Ltd of the UK (FACL, which see) and Gulf Aircraft Maintenance Corporation (GAMCO) and simultaneously launched the Kestrel JP100 business turboprop at the Dubai Air Show. While the aircraft then shown in documents strongly resembled the AIR Epic LT, a legal case opened in January 2005 revealed that AIR and the UK-based FACL had entered into a secret agreement in September 2003 under which AIR was to assist with design, development, construction and certification of the slightly larger Farnborough F1. FACL engineers worked in the US, the 2006 dispute being based around the contribution of this team to the final Epic LT and F1 configurations.

Pending resolution of this dispute, FACL was said in January 2006 to have suspended the agreement with GAMCO while remaining in contact. Following arbitration in May 2006, AIR

was precluded from using the wing developed jointly for the Epic LT and Farnborough F1 on the jet version of the former aircraft. The latter made its maiden flight in the US in July 2006, returning to the UK in the following month for cabin outfitting before being flown to Abu Dhabi for a promotional tour of the Persian Gulf region. MoU with GAMCO reportedly renewed in late 2006.

GAP KESTREL JP100

Engineering designation: Farnborough F1C3

TYPE: Business turboprop.

PROGRAMME: Launched by Farnborough-Aircraft.com Ltd 14 October 1999, at which time initial wind tunnel testing had been completed. Further wind tunnel testing verified laminar wing design and performance of Fowler flap system. Assets of original company acquired by FACL mid-2002; investment to complete development apparently in place by late 2004, at which time more than 65,000 hours of development work completed and parts manufacture said to be under way, with maiden flight then predicted during first half of 2005. Prototype subsequently completed in Oregon by workforce of British and US engineers, undergoing revision of original design; registered N352F on 15 September 2005 and made maiden flight at Bend, Oregon, on 29 July 2006. Flown back to UK 28 August 2006 prior to outfitting and promotional tour in Persian Gulf area. Will then begin certification to EASA CS-23 and FAR Pt 23.

CUSTOMERS: Intended for air taxi operators providing on-demand point-to-point travel from small airfields. Initial market estimated to be 250 per year from 2007.



Prototype GAP Kestrel JP100/Farnborough F1 during early test flying in US

1158836



GAP Kestrel JP100/Farnborough F1

1158837

COSTS: Predicted unit cost, equipped USD2.2 million (2003).

DESIGN FEATURES: Designed with heavy reliance on computational fluid dynamics, backed up by wind tunnel tests. Design goals include ability to operate from small airstrips, carrying five passengers at more than 325 kt (602 km/h; 374 mph) over a range of 1,000 n miles (1,852 km; 1,150 miles) with NBAA IFR reserves. Sidestick controls; low-rpm propeller for low noise.

Wing aerofoil proprietary High-Lift, Laminar Flow sections: HLLF29155 at root, HLLF13130 at tip.

In comparison with original F1, Kestrel version has progressive wing leading-edge sweepback with additional span in place of winglets; horn-balanced rudder; plain flaps; two-piece windscreen; and circular cabin windows.

FLYING CONTROLS: Unpowered sidestick connected to conventional controls; 30 per cent chord Fowler flaps occupy approximately two-thirds span. Novel Fowler mechanism retracts almost entirely into wing.

STRUCTURE: Primarily carbon composites; fuselage of carbon fibre skins with foam core, moulded in two vertically split halves; two-spar carbon fibre wing with aluminium alloy landing gear pick-up ribs, flap tracks and aileron attachments.

LANDING GEAR: Retractable tricycle type; trailing-link main units retract inwards, nosewheel rearwards.

POWER PLANT: One Pratt & Whitney PT6A-67B turboprop, flat rated at 746 kW (1,000 shp). Integral, gravity-fed fuel tank in each wing, combined capacity 965 litres (255 US gallons; 212 Imp gallons).

ACCOMMODATION: Pilot and five or six passengers in pressurised cabin (four-person club seating in prototype), maximum pressure differential 0.55 bar (8.0 lb/sq in) maintaining sea

level cabin altitude to 5,790 m (19,000 ft). Three cabin windows on each side; drop-down airstair door on starboard side aft of wing; overwing emergency exit on starboard side. Lavatory at rear of cabin. Alternative configurations for commuter, medevac and cargo applications.

SYSTEMS: Hydraulic system for landing gear actuation. Electrical power (28 V DC) provided by 200 A starter/generator and 120 A alternator; 40 Ah main battery for engine start and systems power in event of engine failure. Wing leading-edges de-iced electrically. Environmental control system and supplemental oxygen system.

AVIONICS: 'Glass cockpit' compatible with existing and planned ATC procedures and GPS-based en-route navigation and airfield approach systems. Weather radar in wingtip pod.

DIMENSIONS, EXTERNAL:

Wing span	13.11 m (43 ft 0 in)
Length overall	11.40 m (37 ft 4 3/4 in)
Height overall	3.84 m (12 ft 7 1/4 in)

DIMENSIONS, INTERNAL:

Cabin (firewall to pressure bulkhead):	
Length	5.36 m (17 ft 7 in)
Max width	1.52 m (5 ft 0 in)
Max height	1.40 m (4 ft 7 in)

WEIGHTS AND LOADINGS:

Weight empty	1,818 kg (4,007 lb)
Max T-O weight	2,835 kg (6,250 lb)
Max power loading	3.80 kg/kW (6.25 lb/shp)

PERFORMANCE:

Max cruising speed	352 kt (652 km/h; 405 mph)
Econ cruising speed	249 kt (461 km/h; 287 mph)
Stalling speed, flaps down	61 kt (113 km/h; 71 mph)
Max rate of climb at S/L	more than 1,219 m (4,000 ft)/min
Time to FL250	9 min
Service ceiling	9,450 m (31,000 ft)
T-O to 15 m (50 ft)	492 m (1,612 ft)
Range: with max fuel	1,618 n miles (2,996 km; 1,861 miles)
with four occupants, IFR:	
NBAA reserves	1,427 n miles (2,642 km; 1,642 miles)
no reserves	1,567 n miles (2,902 km; 1,810 miles)
Ferry range	1,997 n miles (3,698 km; 2,298 miles)

IBIS

IBIS AEROSPACE LTD

PARTICIPATING COMPANIES

Aero Vodochody: see Czech Republic

AIDC: see Taiwan

EUROPEAN SALES OFFICE:

250 70 Odolena Voda, Czech Republic

Tel: (+420 2) 86 03 31 19

Fax: (+420 2) 83 97 00 55

US SALES OFFICE:

5804 Babcock Road, Suite 257, San Antonio, Texas 78240

Tel: (+1 210) 694 23 32

Fax: (+1 210) 697 96 12

e-mail: ibisamerica@swbell.net

Web: www.ibisaerospace.com

PRESIDENT: Jiri Fidrnsky

GENERAL MANAGER, AMERICAS: Wayne Plucker

FAR EAST SALES OFFICE:

1141-4, Lane 68, Fu-Hsing North Road, Taichung, Taiwan

Tel: (+886 4) 22 56 28 61

Fax: (+886 4) 22 56 23 25

Ibis Aerospace Ltd is a 50-50 joint venture company created by an agreement of 15 March

1997 under which Aero Vodochody and AIDC-developed the Ae 270 Spirit single-turboprop utility aircraft. By early 2005, three prototypes and two production conforming aircraft had flown, and although certification has been achieved of a basic variant, full-scale manufacture had not been authorised by early 2007.

IBIS Ae 270 SPIRIT

TYPE: Light utility turboprop.

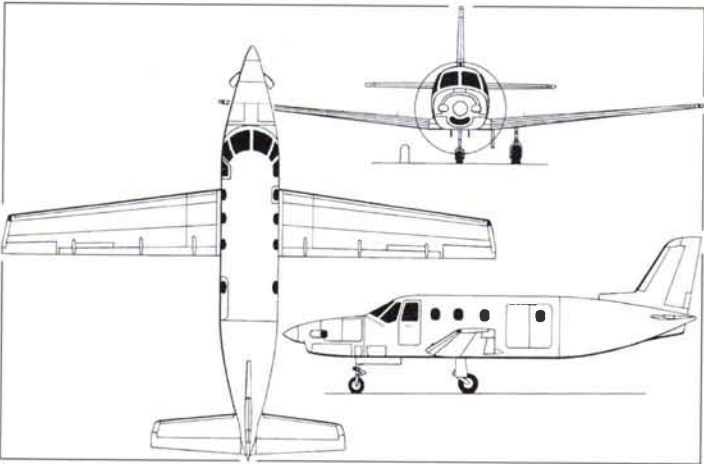
PROGRAMME: Announced by Aero Vodochody of Czech Republic in early 1990, originally as L-270; configuration modified 1991; originally planned in two versions (Ae 270 U and Ae 270 MP), but revised late 1993 and name Ibis introduced; design frozen 1995. Chief designer Jan Mikula. Three flying prototypes (Nos. 1, 3 and 5), plus one each for static and fatigue testing (Nos. 2 and 4, respectively); to be certified under FAR Pt 23 (Normal category) and be suitable for FAR Pt 135 single-pilot IFR. Wings for first prototype (Ae 270 P) received from Taiwan August 1999. Roll-out delayed by late arrival of some components, but took place on 10 December 1999; first flight (OK-EMA) 25 July 2000 and to VZLU test centre 23 October 2000. Third prototype (second flying, OK-SAR) rolled out 2 November 2001; first flight 23 December 2001 (not announced until 11 January 2002) followed by fifth prototype (third flying, first production conforming, OK-LIB) on 24 January 2003, although 'official' first flight was not until 25 February 2003. Sixth prototype (fourth flying, OK-INA) first flown 22 September 2003, and made the type's US debut at the NBAA Convention in Orlando 6 October 2003. Second production conforming aircraft (OK-EVA) flew 24 February 2004.

Certification of Ae 270 P originally expected mid-2002, followed by Ae 270 HP in fourth quarter; first deliveries (Ae 270 P) anticipated in October 2002, with Ae 270 HP deliveries commencing in early 2003. This not achieved, and at NBAA Convention at Orlando, Florida, in September 2002, Ibis announced suspension of Ae 270 P in order to concentrate



Ibis Ae 270P Spirit utility turboprop

1037993



Ibis Aerospace Ae 270 W (Mike Keep)

1154678

resources on Ae 270 HP. EASA certification granted 12 December 2005 following a flight test programme involving two prototypes and a preproduction aircraft which jointly logged 1,416 hours, 40 minutes. FAA certification 24 February 2006.

In 2004, AIDC withdrew from production of wing and announced cessation of Ae 270 funding. Ibis was attempting in mid-2005 to interest original partners, and others, in funding development of a redesigned aircraft to be known as Ae 270B, with 200 kg (441 lb) reduction in empty weight, achieved by changes to wing, empennage and systems; this to restore target 260 kt (482 km/h; 299 mph) cruising speed and 400 kg (882 lb) payload.

In early 2007, Ae 270B was in suspension, awaiting additional funding. Ibis, in cooperation with Aero Vodochody and Taiwan's AIDC, were studying an interim version, then undesignated, which would upgrade performance of current certified aircraft. Most significant change would be to wing's planform and size, although several systems changes and additional fuel capacity are also envisaged. Version is intermediate step more significant programme of changes for Ae 270B. If decision is made to produce interim aircraft, it would be available in 2007-2008.

CURRENT VERSIONS: **Ae 270 P:** Basic pressurised version, with 634 kW (850 shp) flat rated P&WC PT6A-42A engine, Honeywell avionics and retractable gear.

Ae 270 HP: High-performance version, announced 7 October 2000 at NBAA Convention in New Orleans; PT6A-66A engine offering improved speed, climb and altitude performance and greater fuel efficiency. Aircraft 05 is prototype for this version, which is the first to be certified. *As described.*

Ae 270 W: Non-pressurised model (previously called Ae 270 U), with fixed landing gear, Walter M 601F engine and Czech avionics. Plans for this version in abeyance in 2001.

Ae 270 FP and FW: Wheeled-float versions of P and W. Not currently promoted.

CUSTOMERS: Initial orders announced at Paris Air Show, June 2001, involved 51 aircraft for six regional distributors (four in USA, one each in Australia and South Africa). Firm orders for 76 by October 2004.

COSTS: USD2.195 million (2004).

DESIGN FEATURES: Sized between Socata TBM 700 and Pilatus PC-12. High-aspect ratio low wing, circular cabin windows, sweptback vertical tail. Fence added to upper surface of wings, approx 1.12 m (3 ft 8 in) outboard, by 2003.

Medium-speed aerofoil section (thickness/chord ratio 17 per cent at root, 12 per cent at tip); leading-edge sweepback 7° 42'; dihedral 6°; incidence 3°; twist 3°.

FLYING CONTROLS: Conventional and manual. Elevators trimmed mechanically, ailerons and rudder electromechanically; trim tab in rudder. Wide-span single-slotted Fowler flaps (70 per cent of trailing-edge; positions 0, 20 and 36°) actuated hydraulically. Autopilot optional. Control surface movements: ailerons +22.5°/-13.5°; elevators +30°/-15°; rudder ±25°.

STRUCTURE: All-metal semi-monocoque, with fail-safe structural elements in fuselage and two-spar wings. Fuselage of conventionally formed sheet metal bulkheads, stringers and skin; wings (built by AIDC) have formed sheet metal ribs, stringers and chemically milled skin. Production in Czech Republic (including engine compartment by Moravan, cabin floor panels by LZ and rear fuselage, fin and rudder by EV-AT) except for wings and landing gear, produced in Taiwan by AIDC; final assembly by Aero Vodochody. Other suppliers include: Chelton-Systems (EFIS display), De Crane Aircraft Seating (crew and cabin seats); Gumotex Breclav (de-icer boots), Honeywell (air conditioning and pressurisation components), Inter technique (fuel gauges), Jihlavan (hydraulic system), Mikrotechna Modrany (instrumentation), Moravan (wheels and brakes), PPG Industries (windows) SimCom (pilot and technical training), Southstar Aircraft Interiors (interior completion), and UNIS (automated electronic monitoring systems).

LANDING GEAR: Retractable tricycle type by Technometra Radotin, with Moravan wheels and brakes; steerable nosewheel (60° by brakes, 15° by rudder pedals). Bulged nosewheel doors inward retraction for mainwheels, rearward for nosewheel. Oleo-pneumatic shock-absorbers

in all units; hydraulic disc brakes on mainwheels, Dunlop tubeless tyres: size 6.50-10, pressure 6.90 bar (100 lb/sq in) on mainwheels, size 6.00 6, pressure 3.80 bar (55 lb/sq in) on nosewheel. Minimum ground turning radius (based on nosewheel) 4.00 m (13 ft 1½ in). POWER PLANT: One 634 kW (850 shp) (flat rated) Pratt & Whitney Canada PT6A-66A turboprop, driving a Hartzell HC-E4N-3P/D9511FASK/D-630-3 four-blade, constant-speed, feathering and reversing propeller.

Integral fuel tank in each wing centre-section, combined usable capacity 1,152 litres (304 US gallons; 334 Imp gallons). Gravity refuelling point in top of each wing. Oil capacity 5.7 litres (1.5 US gallons; 1.25 Imp gallons) in Ae 270 P.

ACCOMMODATION: Flight crew of two standard, but to be certified for single-pilot operation. Main cabin suitable for up to eight passengers or 1,200 kg (2,645 lb) of cargo, or combinations of both. Six/seven-seat business or four-seat club layouts permit inclusion of lavatory. Medevac configuration provides accommodation for two stretcher cases and two medical attendants. Forward-opening crew door at front on port side; upward-opening passenger/cargo door on port side aft of wing with optional airstair door inset; downward-opening door extension, immediately to rear to provide freight loading aperture; overwing emergency exit on starboard side. Baggage door on starboard side at rear. Cockpit and cabin air conditioning, pressurisation and windscreen heating standard.

SYSTEMS: Electrical power provided by 28 V 250 A DC engine-driven starter/generator and 24 V 42 Ah lead-acid battery; 28 V DC external power connector. Standby generator optional. Hydraulic system, pressure 150 bar (2,175 lb/sq in), for actuation of flaps, mainwheel brakes and landing gear extension/retraction; flow rate 11 litres (2.9 US gallons; 2.4 Imp gallons/min). Landing gear and mainwheel brakes also controllable by separate emergency hand-operated valves and parking brake.

Honeywell air conditioning and pressurisation system maintains differential of 0.30 bar (4.4 lb/sq in) up to altitude 7,500 m (24,600 ft). Gumotex pneumatic (engine bleed air) de-icing of wing and tailplane leading-edges; electric de-icing of windcreens, propeller blades; hot air de-icing of engine air intake; stall warning sensor and pitot tube standard on both models. Eros emergency oxygen system for crew and passengers.

AVIONICS: Standard flight, navigation and engine instrumentation (VFR or IFR) to comply with FAR Pt 23.

Honeywell APEX integrated avionics system will be offered as an option in the future, comprising three-tube active matrix liquid crystal display EFIS, EICAS, digital autopilot and FMS, Mode S transponder and weather radar. Other options will include TCAS, EGPWS, DME and Honeywell Flight Information Service.

Radar: Weather radar optional.

Flight: IFR package standard for business versions, including VOR/ILS, ADF, Trimble GPS, Bendix King KFC 325 autopilot and Ryan 9900BX TCAS.

Instrumentation: Chelton Systems FlightLogic synthetic vision EFIS optional.

DIMENSIONS, EXTERNAL:

Wing span	14.13 m (46 ft 4¼ in)
Wing chord: at root	1.88 m (6 ft 2 in)
at tip	1.04 m (3 ft 5 in)
Wing aspect ratio	9.1
Length overall	12.23 m (40 ft 1½ in)
Fuselage: Length	12.23 m (40 ft 1½ in)
Max width	1.60 m (5 ft 3 in)
Max depth	1.75 m (5 ft 9 in)
Height overall	4.78 m (15 ft 8¼ in)
Elevator span	5.40 m (17 ft 8½ in)
Wheel track	2.83 m (9 ft 3½ in)
Wheelbase	3.53 m (11 ft 7 in)
Propeller diameter:	2.44 m (8 ft 0 in)
Propeller ground clearance:	
Hartzell	0.41 m (1 ft 4¼ in)
McCauley	0.44 m (1 ft 5¼ in)

Passenger/cargo door (port, rear):	
Height	1.30 m (4 ft 3¼ in)
Width	1.25 m (4 ft 1¼ in)
Height to sill	1.30 m (4 ft 3¼ in)
Crew door (port, fwd): Height	1.20 m (3 ft 11¼ in)
Width	0.70 m (2 ft 3½ in)
Height to sill	1.30 m (4 ft 3¼ in)
Emergency exit (stbd, overwing):	
Height	0.71 m (2 ft 4 in)
Width	0.50 m (1 ft 7¾ in)

DIMENSIONS, INTERNAL:

Cabin: Length: excl flight deck	4.98 m (16 ft 4 in)
incl flight deck	5.50 m (18 ft 0½ in)
Max width	1.45 m (4 ft 9 in)
Max height	1.36 m (4 ft 5½ in)
Volume	7.5 m³ (265 cu ft)
Baggage compartment volume	0.73 m³ (25.8 cu ft)

AREAS:

Wings, gross	21.00 m² (226.0 sq ft)
Ailerons (total)	1.00 m² (10.76 sq ft)

Trailing-edge flaps (total)	4.22 m ² (45.42 sq ft)
Spoilers (total)	0.325 m ² (3.50 sq ft)
Fin, incl dorsal fin	1.96 m ² (21.10 sq ft)
Rudder, incl tab	1.11 m ² (11.95 sq ft)
Tailplane	2.975 m ² (32.02 sq ft)
Elevators (total)	1.885 m ² (20.29 sq ft)
WEIGHTS AND LOADINGS (Ae 270 HP):	
Empty weight	2,436 kg (5,370 lb)
Weight empty, equipped	2,710 kg (5,974 lb)
Max fuel weight	1,034 kg (2,280 lb)
Max T-O weight	3,800 kg (8,377 lb)
Max ramp weight	3,820 kg (8,422 lb)
Max landing weight	3,700 kg (8,157 lb)
Max baggage weight	60 kg (132 lb)
Max zero-fuel weight	3,500 kg (7,716 lb)
Max wing loading	181.0 kg/m ² (37.06 lb/sq ft)
Max power loading	6.00 kg/kW (9.86 lb/shp)

PERFORMANCE (Ae 270 HP):	
Max cruising speed: at S/L	220 kt (407 km/h; 253 mph)
at FL 200	270 kt (500 km/h; 311 mph)
Stalling speed, engine idling:	
flaps up	85 kt (158 km/h; 98 mph)
flaps down	66 kt (123 km/h; 76 mph)
Max rate of climb at S/L	521 m (1,710 ft)/min
Max certified altitude	7,925 m (26,000 ft)
T-O run	270 m (890 ft)
T-O to 15 m (50 ft)	550 m (1,805 ft)
Landing from 15 m (50 ft)	500 m (1,640 ft)
Landing run	167 m (1,545 ft)
Range with max fuel at FL 300:	
30 min reserves	1,610 n miles (2,981 km; 1,852 miles)
NBAA IFR reserves	1,420 n miles (2,629 km; 1,634 miles)

ILYUSHIN/IRKUT/HAL

ILYUSHIN/IRKUT/HAL

PARTICIPATING COMPANIES:

Ilyushin: see Russian Federation
Irkut: see Russian Federation
HAL: see India

PROGRAMME DIRECTOR: Aleksandr Kuleshov (Irkut)

e-mail: irta@irkut.com

Agreement announced between these three companies in June 2001 for joint design, development and co-production of a multirole transport aircraft (MTA), now known also as IRTA-21. It will be funded 50 per cent by HAL, 40 per cent by Irkut and 10 per cent by Ilyushin with total planned investment in the region of USD380 million. Production lines in both countries are planned. Under agreement of January 2002, both HAL and Russian partners are to transfer conceptual draft for series production and technology information during the design, development and productionisation planning stages. Further joint accord signed 16 November 2005, HAL will create infrastructure for design, development and manufacturing programme and commercial production in India; similar facilities in Russia will be established by Ilyushin and Irkut.

ILYUSHIN/IRKUT/HAL IRTA-21

TYPE: Medium transport/multirole.

PROGRAMME: This Indian requirement for a multirole transport aircraft (MTA) became the subject of a joint venture between HAL and Ilyushin (Russian designation Il-214) following the opening of negotiations in March 1999; joint agreement signed later in the same year; MoU in late 2000 followed in June 2001 by joint design, development and co-production agreement involving these two companies plus Irkut. Aircraft redesignated in 2003 as IRTA-21 (Indo-Russian Transport Aircraft, 21st century).

Configuration now differs considerably from the original design of 1996. Programme is included in Russian government's aeronautical development plan for 2001–15. Engineering concept and feasibility study completed by early 2004; preliminary design then begun; static and life cycle tests due for 2006; first flight in 2008; tactical transport version targeted to enter service in 2009.

CURRENT VERSIONS: **Airliner:** With cabin windows and seating for 94 to 104.

Tactical transport: Military version with rear-loading ramp; provision for 82 troops or 74 paratroops; or 60 casualties in medevac configuration; or containerised, palletised or bulk cargo.

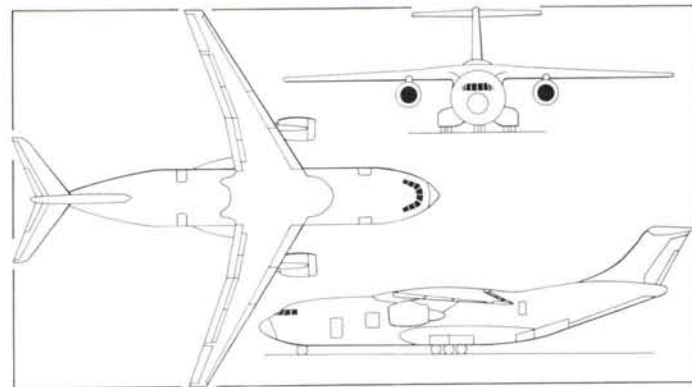
Commercial freighter: With rear-loading ramp.

CUSTOMERS: Required by Indian and Russian air forces; manufacture by HAL and Irkut. Initial Indian Air Force commitment for 45; estimated Russian requirement for up to 100.



Artist's impression of Ilyushin/Irkut/HAL IRTA-21

1159034



Russia and India's new multirole transport aircraft, the IRTA-21

(Paul Jackson)

0062411

COSTS: Development funding of USD190 million each planned by Russia and India, according to joint agreement signed on 16 November 2005. Unit cost USD25 million to USD29 million. Target price is 20 per cent less than for comparable aircraft.

DESIGN FEATURES: Sweptback high-wing monoplane with all-swept T tail; twin, underslung podded engines; upswept rear fuselage with rear-loading ramp. Intended to replace ageing An-12, An-26 and An-32. Operable from unpaved airfields with surface density 7.5 kg/m² (1.5 lb/sq ft).

FLYING CONTROLS: Digital fly-by-wire. Fowler-type flaps.

STRUCTURE: Aluminium alloy and composites.

LANDING GEAR: Tricycle type; retractable. Two four-wheel main bogies retracting upwards into sponsons on fuselage hips; twin nosewheels.

POWER PLANT: Two 103 kN (23,150 lb st) class turbofans. Options include CFM56, Aviadvigatel PS-12 (under development), Rolls-Royce BR715, PW6000 or IAE V2500.

ACCOMMODATION: See Current Versions above.

AVIONICS: Integrated suite includes flight and navigation complex, flight deck information and control, com radios and sighting system. Six multifunction displays; two HUDs.

Following details all provisional:

DIMENSIONS, EXTERNAL:

Wing span	32.25 m (105 ft 9¾ in)
Length overall	35.20 m (115 ft 5¼ in)
Height overall	11.00 m (36 ft 1 in)

DIMENSIONS, INTERNAL:

Cargo hold:	
Length: excl ramp	13.85 m (45 ft 5¼ in)
incl ramp	18.85 m (61 ft 10¼ in)
Max width at floor	3.45 m (11 ft 3¾ in)
Max height	3.40 m (11 ft 1¾ in)

WEIGHTS AND LOADINGS (design):

Max cargo payload	18,500 kg (40,785 lb)
Max fuel weight	13,650 kg (30,093 lb)
Max T-O weight	55,000 kg (121,250 lb)
Max landing weight	49,000 kg (108,026 lb)

PERFORMANCE (estimated):

Max level speed	469 kt (870 km/h; 540 mph)
Normal cruising speed	432 kt (800 km/h; 497 mph)
Airdropping speed	135 kt (250 km/h; 155 mph)
Normal operating altitude	13,000 m (42,650 ft)
T-O run at S/L	1,300 m (4,265 ft)
Landing from 15 m (50 ft)	1,350 m (4,430 ft)
Range: airliner with max payload	1,889 n miles (3,500 km; 2,174 miles)
tactical transport:	
with 4,500 kg (9,920 lb) payload	3,239 n miles (6,000 km; 3,728 miles)
with max payload	1,349 n miles (2,500 km; 1,553 miles)

For details of the latest updates to *Jane's All the World's Aircraft* online and to discover the additional information available exclusively to online subscribers please visit
jawa.janes.com

NH INDUSTRIES

NH INDUSTRIES SARL

Le Quartz, Batiment C, 42 route de Galice, F-13090 Aix-en-Provence, France
Tel: (+33 4) 42 95 97 00
Fax: (+33 4) 42 95 97 49
e-mail: NH90@nhindustries.com
Web: www.nhindustries.com
GENERAL MANAGER: Mrs Gala Goncalves

PARTICIPATING COMPANIES

- AgustaWestland: International
- EADS Eurocopter: International
- EADS Eurocopter Deutschland: Germany
- Stork Fokker AESP: Netherlands

NH Industries (NATO Helicopter Industries) established August 1992 to manage design and development of NH90 and is also responsible for production, logistic support, marketing and sales; in October 1995, workshares were slightly amended to Agusta 28.2 per cent, Eurocopter Deutschland 23.7 per cent, Eurocopter France 41.6 per cent, Fokker Aircraft 6.5 per cent, NFI (Norway) joined in 1994 as risk-sharing partner of Eurocopter France. Further amendment occurred on 21 June 2001, when Portugal joined programme and allocated 1.2 per cent share to OGMA. Netherlands activities transferred to Fokker Aerostructures BV following bankruptcy of the former Fokker Aircraft. Industrial ownership (and production share) is now EADS 61.7 per cent, Finmeccanica (AgustaWestland) 31.6 per cent, Stork Fokker 5.5 per cent and Portuguese industry (as Eurocopter and AgustaWestland subcontractor) 1.2 per cent. Joint agency NAHEMA (NATO Helicopter Management Agency) formed February 1992 by the four governments, within NATO framework, to manage programme; now additionally represents Portuguese government; NAHEMA located alongside NH Industries in Aix-en-Provence.

NH INDUSTRIES NH90

Australian military designation: MRH90

Swedish military designation: Hkp 14

TYPE: Multirole medium helicopter.

PROGRAMME:

DEVELOPMENT MILESTONES

Requirement issued	83-84
Design began	Dec 86
Official go-ahead	26 Apr 90
First order (multinational)	30 Jun 00
Rolled out	29 Sep 95
First flight	18 Dec 95
Official first flight	15 Feb 96
Public debut	May 96
First flight, production	4 May 04
First delivery (planned)	06

Initial studies by NIAG (NATO Industrial Advisory Group) SG14 in 1983-84; September 1985 MoU between defence ministers of France, Germany, Italy, Netherlands and UK (USA and Canada having already withdrawn) preceded 14 month feasibility/predefinition study for new naval/army NH90 (NATO helicopter for the 1990s); initial design phase approved December 1986; second MoU in September 1987 led to predefinition phase and completion of weapons system definition in 1988; UK withdrew from programme April 1987; German workshare reduced early 1990, Italian participation renegotiated later 1990; French and German launch decision 26 April 1990; two ministerial MoUs in December 1990 and June 1991 cover design and development responsibilities; intercompany agreement signed March 1992; design and development contract signed 1 September 1992; five prototypes and GTV (ground test vehicle) completed, with three prototypes produced in France, TTH in Germany and NFH in Italy; assembly of first prototype began at Marignane, October 1993; first flight 18 December 1995. All five prototypes flying by December 1999.

Development suspended May 1994; restarted July 1994, but all new-development items subject to rigorous cost examination; preference for off-the-shelf components. Programme



NH Industries NH90 of German Army

doubts dispelled by inclusion of NH90 in French defence plan adopted in June 1996, which required first NFH delivery to Aéronavale in 2004 (not achieved) and first TTH to ALAT in 2011. Bid for production investment and Lot 1 manufacture submitted 5 October 1997; four nations signed political authorisation for first production batch of 154 (amended later to 151) helicopters on 19 May 1998; pricing proposals submitted by NHI to NAHEMA on 15 July 1998; industrial contract due in mid-1999 to permit first deliveries in 2003 for Netherlands Navy, but was delayed and latter date rescheduled to 2007.

In September 1999, Germany revealed a cut of 24 in its total order and then planned to receive first TTH in April 2004 and NFH in 2007, instead of withdrawing current Westland Lynx in 2003; however, delivery of first TTH subsequently slipped to early 2006. Italian deliveries (both versions) planned to begin in April 2004, continuing until 2017-18, but start of deliveries delayed until 2006, NH90 built on parallel production lines in France, Germany and Italy, with peak rate of 40 helicopters per year anticipated. Aircraft for Finland, Norway and Sweden will be completed on fourth assembly line at Patria's Jamsa site. Netherlands confirmed in November 1998 that its helicopters would be built in Italy; German NFHs built in France. Further, in 1998, a basic NH90 variant was proposed to which 'Kits on Option' could be added to produce specific variants at lower cost than purpose-build.

Rescheduled production contract signature, at Berlin Air Show, 8 June 2000, replaced by MoU committing to 243, plus 55 options and minimum buy of 366 from stated requirements for 595. Production investment and production contract finally signed in Paris on 30 June



Maiden flight of Italian Army's first NH90

1153794



NHIndustries NH90 prototype PT2 visiting Netherlands (R Neth Navy)

1153792

2000 on these terms and quoting cost for 298 as €6.6 billion, with industrial participants providing 25 per cent of production investment. Portuguese contract signed at Paris Air Show on 21 June 2001 added fifth member to consortium and 10 aircraft to previous figures, for new totals of 253 firm, 376 minimum purchase and 605 stated requirement. This further increased by 52 in September 2001 on selection of NH90 for Nordic Standard Helicopter Project, programme offsets including production by Saab of 200 forward fuselages.

On 6 October 1995, NAHEMA contracted NHI to undertake additional work and national customisation, involving integration of T700 engine to meet Italian requirement; design of rear ramp installation for TTH version; and reinforcement for carriage of stores up to 700 kg (1,543 lb). Associated national requirements include study of command post version; cannon pod, sand filter, radiometer; second VHF/FM radio for TTH; and sonobuoy data relay, Tacan and rear ramp for NFH. Total value of €58.23 million slightly amends national workshares. Italy formally confirmed T700 engine selection in June 2000; Germany and Netherlands simultaneously confirmed RTM322, which earlier selected by France.

First five aircraft had flown more than 2,500 hours by end of November 2003. Flight envelope expanded by early 2002 to 190 kt (352 km/h; 219 mph), 6,096 m (20,000 ft) altitude and T-O weight of 10,600 kg (23,369 lb). The aircraft has also demonstrated fast rolling landings at 50 kt (93 km/h; 58 mph) and landings on slopes of up to 12°. Flight test activity in 2003 mainly dedicated to mission system qualification. Initial production aircraft (TTH for German Army, TGEA01, temporarily serialled 9891) first flew at Donauwörth 4 May 2004 and made public debut at ILA, Berlin, 11 May; first production examples for Finland and Italy both made maiden flights 15 September 2004, with first 'high cabin' aircraft for Sweden following suit on 18 March 2005. First Italian Navy NFH made initial flight from Vergiate on 15 December 2005. By end of 2005, over 3,600 flight hours had been accumulated, including just over 3,000 by five development machines, with balance accounted for by early production helicopters.

CURRENT VERSIONS (general): NFH: (NATO Frigate Helicopter) Naval version, primarily for autonomous ASW and ASVW; additional applications include OTH targeting, vertrep, SAR, transport and anti-air warfare support; designed for all-weather/severe ship motion environment; fully integrated mission system for crew of three (optionally four); ECM, anti radar and IR protection systems. Italy considering a unique sensor fit from FTAR/Honeywell consortium. Agusta, with its EH101 and S 61 experience, is responsible for NFH development and integration. In late 2005, it emerged that software development for Navy mission systems was running behind schedule, with possible 18-month delay in service entry.

TTH: (Tactical Transport Helicopter) Land-based army/air force version, primarily for tactical transport, airborne operations and SAR with up to 20 armed troops or 2.5 tonnes of supplies; additional applications include tactical support, special EW, airborne command post, VIP transport and training; defensive weapons suite; rear loading ramp/door, loading winch and rolling strips to be provided for French, Italian and German armies to accommodate light armoured anti-tank missile vehicle; 4-tonne external underslung load hook; high manoeuvrability and survivability for XO operation near front line. Eurocopter Deutschland is responsible for development of the TTH.

C-SAR: Combat search and rescue version, yet to be fully defined, but probably equipped with refuelling probe, 'bolt on' armour on lower fuselage, two external fuel tanks, flotation gear, secure datalink, integrated countermeasures, FLIR and four FIM-92 Stinger self-defence AAMs.

'Kits on Option': To accommodate differing budgetary and operational requirements, a baseline configuration has been agreed, to which specific packages can be added. French shipborne utility version combining troop seats and ramp could replace Super Frelon. This version could also form basis of dedicated VIP variant, and even of a civil variant. Eurocopter France is responsible for development of the basic helicopter.

Netherlands NFH: All 20 equipped with common core avionics, FCS, 360° radar, FLIR, ESM, ECM and sonics, but only 12 with full mission system; rest for night special operations/insertion and maritime transport duties. To serve aboard eight M-type frigates, four LCF frigates, two LPDs and two AORs; delivery to begin in 2007.

MH90: Version proposed to satisfy Canadian requirement for up to 28 maritime helicopters to replace CH-124 Sea King; NHIndustries teamed with Thales and Lockheed Martin Canada to bid, with latter acting as prime contractor. Sikorsky S 92 eventually selected.

MRH90: Designation allocated to Australian helicopters for delivery from 2007 to 2009.

Civil Version: In latter half of 2004, it was revealed that consideration is being given to developing civil version of NH90 for offshore oil platform support and government/VIP airift. NHIndustries confirmed that civilian helicopter operators have shown interest in NH90, but by mid-2005 it appeared unlikely to move ahead with development of a civil NH90 in the immediate future.

CURRENT VERSIONS (specific): PT1/F-ZWTH: Prototype; common basic configuration, assembled at Marignane; rolled out 29 September 1995; first flight 18 December 1995 with RTM 322 engines; formal debut (official first flight) 15 February 1996; public debut at Berlin, May 1996; tactical (green) colours; with 160 hours logged, PT1 flew to Agusta's Casena Costa plant on 29 July 1997 for installation of Alfa Romeo Avia/GE T700-T6E engines before an 18-month test programme funded by Italy; first flew as such on 13 March 1998; had amassed 205 hours with these engines by August 2000, including sea trials with French 'La Fayette' class frigate *Courbet*, making 62 deck landings in two days (22/23 July 1998). Flown with Italian serial MMX612. Total 365 hours by 31 August 2000, when scheduled flight activities were completed. Employed as static demonstration and marketing airframe.

PT2/F-ZWTJ: Common basic configuration; rolled out November 1996 at Marignane; first flight 19 March 1997; naval (light grey) colours; first with fly-by-wire controls. Initially flew for 5 hours with mechanical back-up flight controls, then first flew with analogue FBW on 2 July 1997; digital FBW installed early 1998 (retaining mechanical backup) and first flown on 15 May. PT2 also first with automatic electric blade folding intended for NFH, and due to receive IR exhaust suppressors. External load tests in fourth quarter of 2002.



NHIndustries NH90 tactical helicopter (Paul Jackson)

1153791

PT3/F-ZWTJ: Common basic configuration: first with core avionics system with AFCS, navigation, communications, IFF and full 'glass' cockpit; retains mechanical control back-up; first flight at Marignane 27 November 1998. Core avionics trials with production-standard LCDs; replaced PT2 in extending flight envelope. De-icing system tests began 13 April 2001, lasting 20 hours. Became first helicopter in world to fly with full quadruplex FBW control system, December 2003; now representative of production standard NH90. Engaged on high altitude performance testing at Latacunga, Ecuador, from 13 September to 5 October 2005.

PT4/9890: TTH configuration: first flight 31 May 1999, at Ottobrunn. First NH90 to be fitted with C-model prototype of DaimlerChrysler Aerospace electronic warfare suite as one element in a fully integrated avionics suite, with LCD cockpit displays, FLIR, helmet sight, tactical control system, secure communications, and radar (with digital mapping). Cleared operation of rear loading ramp and doors open in flight up to 140 kt (259 km/h; 161 mph). Night flights with FLIR and rescue hoist demonstration. Cold weather trials at Iqaluit, Canada, January-February 2003. Undertook operational evaluation with French Army 17 to 30 September 2005.

PT5/MMX613: NFH mission system: first flight at Cascina Costa 22 December 1999. Performed flotation system test. Accomplished initial NH90 deck operating campaign aboard replenishment tanker *Etna*, 2-8 May 2001, with 77 landings and 42 decklock engagements, all in FBW mode. Third series of deck trials, May 2003 (first with deck hook).

GTU: Ground test vehicle at Cascina Costa. Instrumented to monitor 300 parameters. First run 28 September 1995; 539 hours accumulated by June 2000.

CUSTOMERS: See table. Requirements originally estimated as 726 (France 220, Germany 272, Italy 214 and Netherlands 20); reduced to 647 in July 1996, then to 642 in 1998 and 595 in late 1999. These comprise Germany 181 TTH and 38 NFH (= 219); France 133 TTH and 27 NFH (= 160); Italy 150 TTH and 46 NFH (= 196); and Netherlands 20 NFH. Additionally, over 600 export orders are anticipated: NHI is competing for orders from Chile, Malaysia, Poland and Saudi Arabia, amongst others. Selected for Nordic Standard Helicopter Project: Finland (**NH90-TTT**) and Norway announced decision on 13 September 2001, with Sweden following on 18 September. Greece ordered 20 NH90 (with 14 on option) on 29 August 2003. Oman ordered 20 TTHs on 24 July 2004 for delivery by 2008. Australia added 12, designated **MRH90**, on 31 August 2004, although contract not finalised until 2 June 2005; first four to be completed at Marignane, with remaining eight assembled in Australia. Initial delivery in 2007, with first locally assembled MRH90 due for completion September 2008. Further order appears possible, with up to 28 helicopters required to replace S-70A Black Hawk in Army service. New Zealand announced selection of NH90 on 31 March 2005 and will obtain from eight to 10 helicopters. On 20 May 2005, Spain revealed plans for an initial purchase of 45 NH90s. Most recent customer is Belgium, which revealed intent to purchase 10 on 9 December 2005; at that time, total of 357 NH90s on firm order, with at least another 63 awaiting contract finalisation and 120 more subject to option.

NH90 ORDERS				
Customer	TTH	NFH	Total	First flight and location
Australia (Army)	12		12	
Finland (Air Force)	20		20	15 Sep 04 M 13 Jul 05 H
France (Navy)		27	27	M
Germany (Air Force)	30		30	D
(Army)	50		50	4 May 04 D
Greece (Army)	20		20	13 Jul 05 M
Italy (Navy)	10	46	56	15 Dec 05 V (NFH)
(Army)	60		60	15 Sep 04 V
Netherlands (Navy)		20	20	V
Norway (Air Force)		14	14	H
Oman (Air Force)	20		20	
Portugal (Army)	10		10	
Sweden	13	5	18	18 Mar 05 H
(Helicopter Wing)				
Totals	245	112	357	

Notes: German Air Force total includes 23 for combat SAR. First aircraft for Finland built at Marignane; second at Halli; third at Vergiate; remainder at Halli. Locations are D = Donauworth, Germany; H = Halli, Finland; M = Marigane, France; V = Vergiate, Italy. Firm contracts still to be concluded with Belgium (10 NH90s); New Zealand (8-10) and Spain (45)

COSTS: Development cost EUR1,376.15 million (EUR 9.6 billion) (January 1988 values) agreed September 1992, provided by governments and industry; EUR421.83 million French government plus EUR161.24 million Eurocopter France; EUR256.41 million Germany plus EUR74.59 million Eurocopter Deutschland; EUR89.44 million Netherlands plus EUR2.64 million Fokker; and EUR370 million by Italian government. Additional development, agreed October 1995, adds EUR58.23 million. By January 1997, an estimated 75 per cent of R&D costs had been disbursed. Projected flyaway prices (1995) are EUR90 million for TTH and EUR145 million for NFH, but further 15 per cent cut demanded by French military procurement office in February 1996. Initial batch of French NFHs have 2000 unit cost of EUR200 million, including spares and tax; NHI quotes EUR115 million, pre-tax. Netherlands paying NLG1.7 billion (USD510 million) giving a unit price of USD25.5 million per aircraft. Cost of 10 TTH for Portugal quoted as EUR200 million.

DESIGN FEATURES: Compact external dimensions with large cabin (larger and slightly higher than Sikorsky Black Hawk). Low vulnerability/detectability, with aerodynamic and low-observables design, reduced maintenance requirements, and day/night operability within temperature range of -40 to +50°C. Specification requires fewer than 250 failures per 1,000 flight hours; 97.5 per cent mission reliability rate; 87 per cent availability; MTBF better than 4 hours; and under 2.5 mmh/th (excluding engines). Service life of 10,000 hours over 30 years.

Titanium Spheriflex main rotor hub with elastomeric spherical thrust bearings; four blades with advanced aerofoils and curved tips; main rotor turns anticlockwise at 256.6 rpm with 219 m (719 ft)/s tip speed; bearingless tail rotor with four blades of similar design and construction; tail rotor with cross-beam hub turns at 1,235.4 rpm with 207 m (679 ft)/s tip speed; automatic electronic folding of main rotor blades and tail pylon in NFH; manual blade folding (automatic optional) in TTH. Large unobstructed internal volume.

FLYING CONTROLS: Quadruplex fly-by-wire controls eliminate cross-coupling between control axes. NH90 is the world's first FBW transport helicopter. Flight control system developed by Eurocopter France; optimised for NOE flight and minimal vulnerability to small arms damage.

STRUCTURE: All-composites fuselage; fail-safe design of structure, rotating parts and systems for high safety levels. First set of main and tail rotor blades completed for ground testing May 1994; blades have multibox structure and glass and carbon fibre skin; leading-edge box and roved parts of blade prefabricated to reduce time in main mould; resin used reduces material ageing in damp and hot regions; blades designed and manufactured using CATIA CAD/CAM.

Eurocopter France builds rotor, rear gearbox, auxiliary gearbox, fairings and produces wiring, electrical system and air conditioning. Eurocopter Deutschland builds front and centre fuselage and fuel system. Agusta responsible for rear fuselage, main gearbox, hydraulic system and rear ramp; Stork Aerospace for tailboom (first completed unit delivered mid-2003), sliding doors, landing gear and fairings and intermediate gearbox. Assembly lines in France, Germany (TTH only), Italy and Finland (Patria) for the Nordic helicopters. Portuguese industries supply Agusta and Eurocopter with cabin steps, some electrical wiring and engine supports. Saab awarded contract in February 2002 for supply of 200 NH90 forward fuselage sections.

LANDING GEAR: Retractable crashworthy tricycle gear by DAF Special Products with twin-wheel nose unit (tyre size 6.00-6; 10 ply) and single-wheel main units (tyre size 615x225-10; 12 ply); all units retract rearwards; four-balloon emergency flotation gear effective up to Sea State 3. NFH has harpoon-type deck haul-down gear.

POWER PLANT: Two engines; required power from each engine during normal operation at S/L is 1,788 kW (2,398 shp) for 30 minutes, 1,662 kW (2,229 shp) maximum continuous, OEI maximum contingency (2½ minutes) 1,855 kW (2,488 shp), emergency (30 seconds) 2,158 kW (2,895 shp) and continuous (1 h) 1,802 kW (2,417 shp). Engine RFP issued April 1992. Decided on 25 January 1994 that NFH and TTH will be developed and qualified with 1,566 kW (2,100 shp) RTM 322-01/9 made by European consortium of Turbomeca, Rolls-Royce, MTU and Piaggio; during development, the 1,521 kW (2,040 shp) GE T700-T6E1 is being qualified by Alfa Romeo and GE to meet Italian military requirements. In June 2001, USS1 billion contract signed by Eurocopter for supply of production RTM 322-01/9 engines, including initial tranche of 254 power plants for installation in aircraft for France, Germany and Netherlands; same engine also specified for Australian and Omani NH90s. Engine control by FADEC.

Transmission rating 2,925 kW (3,922 shp) with both engines, 2,170 kW (2,910 shp) for 30 seconds OEI. Modular main gearbox features integrated lubrication system with innovative integral monitoring and diagnostic system and, like the two accessory gearboxes, can run dry for 30 minutes.

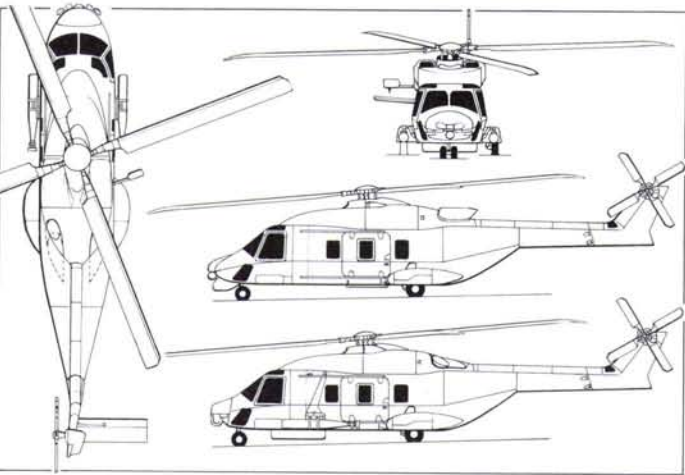
Fuel system has eight Uniroyal crash-resistant self-sealing cells and AFG management system. Total internal capacity approx 2,500 litres (660 US gallons; 550 Imp gallons). Provision for pressure refuelling and hover refuelling. Provision for two external tanks (modified from Alpha Jet) each of 310 litres (82 US gallons; 68 Imp gallons) plus four ferry tanks in cabin.

ACCOMMODATION: Minimum crew one pilot VFR and IFR; NFH crew, pilot, co-pilot/TACCO on flight deck and one system operator in cabin; optionally, two pilots on flight deck and one TACCO, one SENSO in cabin; TTH, two pilots or one pilot and one crewman on flight deck and 14 to 20 equipped troops or 12 stretchers or one 2 tonne tactical vehicle in cabin. Sogerna crew seats and Autoflug composites passenger seats withstand 22 g or 11 m (35 ft/s) vertical descent crash loading. Swedish helicopters have 'high cabin', allowing more room for treatment of patients during SAR missions; for ASW mission, Swedish NH90 will have one operator console permanently installed and capability to add a second within two hours.

SYSTEMS: Full redundancy for all vital systems; hydraulic system has two Vickers mechanically driven and one electrohydraulic and one electric pumps; redundant flight control hydraulic system has two main separated and independent circuits; independent utilities system provides hydraulic power for landing gear and ancillary operations; electrically driven pump as back-up in event of one circuit failing; other circuit permanently supplied in parallel by a utility system pump. Electrical system by Thales has two Saft batteries and three 40 kVA Auxilex AC generators (two driven by main gearbox, one by remote accessory gearbox) feeding DC busses through transformer-rectifiers; 70 kW Microturbo Saphyr 100 APU for electrical engine starting, environmental control on ground and emergency use in flight; Kollmorgen-Artus emergency DC generator (driven by remote accessory gearbox); fire detection and suppression in engine bays, APU and cabin. Microtecnica air conditioning system (with two identical independent units) operating in three zones: cockpit, cabin (both vapour cycle) and main avionics bays (filtered external air). Anti-icing of main blades (standard on TTH, optional on NFH) by heated leading-edge mat (heating carbon coating and not metal parts). Anti-icing system also on tail rotor blades and horizontal stabiliser, and air intakes. Ice protection system effective in maximum conditions defined by DEF-STAN 000-970. Dunlop Aerospace Ice Protection and Composites selected in mid-2002 to design, develop and produce anti-iced engine air intakes for NH90, with serial production starting in 2003.

AVIONICS: Core avionic system based on dual MIL-STD-1553B data highways (one for the core avionics system, one for the mission system) allows integration of aircraft and mission equipment through several computers. Eurocopter France responsible for basic avionics; Eurocopter Deutschland for TTH avionics; Agusta-Westland for NFH mission system.

Comms: Integrated management of communications and identification systems. Two V/UHF; V/UHF DF/homer; HF SSB and Thales TSC 2000 IFF. Elmer intercom.



NHIndustries NH90 NFH, with additional side view (upper) of TTH (Mike Keep)

Radar: NFH has Thales ENR 360° track-while-scan surveillance radar with target recognition capability; TTH has Honeywell weather radar. Telephonics APS-143B(V)3 Ocean Eye multimode surveillance radar chosen for Swedish helicopters.

Flight: Twin INS with embedded GPS and Doppler ground speed sensor; twin air data computers; provision for radio altimeter and M.L.S. SFIM/Alenia flight control computer and Thales/BAE Systems microwave landing system.

Instrumentation: NVG compatible. Five 200 mm (8 in) square Thales LCDs in cockpit of NFH; up to three more in cabin; four (fifth optional) in TTH. TTH has digital map. Central warning system, two remote frequency indicators and conventional analogue back-up instruments. Provision for Thales Topowl binocular helmet-mounted display and sight.

Mission: NFH: Alenia or Thales FLASH dipping sonar, high focal-length tactical FLIR, IFF interrogator, Link 11 datalink including ship-to-air umbilical, ESM and telebrief; electronic warfare subsystem. SAGEM OLOSP electro optical multisensor turret; French NFH has single SAGEM IRIS Thermal imager; Nordic helicopters will operate with two or three sensors, depending on specific mission requirement, but probably including some or all of day TV, IR camera and laser rangefinder. Dedicated video/audio network distributes tactical information to all crew members. TTH: FLIR. Modular tactical mission system (TMS) for Swedish NH90 being developed by Saab under terms of agreement signed with NH Industries on 1 February 2002; sensors include Galileo Avionica FLIR, Thales FLASH-S dipping sonar and radar. Delay in TMS development revealed in mid-2005 expected to result in delivery of operational helicopters to Swedish armed forces being up to two years later than originally planned.

Self-defence: Provision for MAWS, RWR, LWR, Matra chaff/flare and IR jammer. TTH has self-protection suite with passive threat warning system known as EWS (electronic warfare suite) with EADS laser warning receiver, LFK AN/AAR-60 MILDS (missile launch detection system) and Thales EW processor and radar warning receiver. Active elements of self-protection suite include MBDA Saphir-M chaff/flare dispenser system and IR jammer. Norway selected ITT Avionics AN/ALQ-211 SIRFC in first quarter 2002. Swedish NH90 self-protection EW suite developed jointly by Saab Avionics of Sweden and Avtronics of South Africa. Includes radar, missile and laser warning capabilities and countermeasures dispensing equipment.

EQUIPMENT: Rosenmount windscreen washers/wipers; Siren 5 tonne cargo hook and rescue hoist. NFH has Magnaghi 5 ton deck restraint harpoon and automatic main rotor blade and tail folding.

ARMAMENT: TTH can have area suppression and self-defence armament; NFH to carry air-to-surface missiles weighing up to 400 kg (882 lb) and anti-submarine torpedoes (including Murène 90); air-to-air missiles optional. Italian NFH will carry Marte Mk 2/S.

DIMENSIONS, EXTERNAL:	
Main rotor diameter	16.30 m (53 ft 5½ in)
Main rotor blade chord	0.65 m (2 ft 1½ in)
Tail rotor diameter	3.20 m (10 ft 6 in)
Tail rotor blade chord	0.32 m (1 ft 0½ in)
Length: overall, rotors turning	19.565 m (64 ft 2¼ in)
fuselage (NFH)	16.09 m (52 ft 8¼ in)
folded (NFH)	13.50 m (44 ft 3½ in)
Height: folded (NFH)	4.16 m (13 ft 7¾ in)
overall, tail rotor turning	5.31 m (17 ft 5 in)
Width: max (incl tailplane):	
NFH clean	4.515 m (14 ft 9¾ in)
NFH with torpedoes	4.625 m (15 ft 2 in)
over mainwheel fairings	3.63 m (11 ft 11 in)
over torpedoes (NFH)	3.85 m (12 ft 7½ in)
fuselage max	2.60 m (8 ft 6¼ in)
folded (NFH)	3.63 m (11 ft 11 in)
Tailplane half-span (stbd)	2.79 m (9 ft 1¼ in)

Wheel track	3.20 m (10 ft 6 in)
Wheelbase	6.08 m (19 ft 11½ in)
Rear-loading ramp: Length	1.58 m (5 ft 2¼ in)
Width	1.78 m (5 ft 10 in)
Cabin door: Width	1.60 m (5 ft 3 in)
Height	1.50 m (4 ft 11 in)
DIMENSIONS, INTERNAL:	
Cabin: Length: excl rear ramp	4.80 m (15 ft 9 in)
incl rear ramp	6.17 m (20 ft 3 in)
Min usable width	2.00 m (6 ft 6¾ in)
Min usable height: standard	1.58 m (5 ft 2¼ in)
'high cabin'	1.82 m (5 ft 11¾ in)
Volume: standard	15.2 m³ (537 cu ft)
'high cabin'	17.5 m³ (618 cu ft)

AREAS:	
Main rotor disc	208.67 m² (2,246.1 sq ft)
Tail rotor disc	8.04 m² (86.57 sq ft)

WEIGHTS AND LOADINGS:	
Weight empty: basic: NFH	6,288 kg (13,863 lb)
TTH	5,945 kg (13,106 lb)
equipped: TTH	6,200 kg (13,669 lb)
Standard fuel: NFH (usable)	2,036 kg (4,489 lb)
Max payload: TTH	2,500 kg (5,511 lb)

T-O weight, TTH, NFH:	
typical mission	10,000 kg (22,046 lb)
max	10,600 kg (23,369 lb)
Max disc loading	50.8 kg/m² (10.40 lb/sq ft)
Transmission loading at max T-O weight and power	3.62 kg/kW (5.96 lb/shp)

PERFORMANCE (TTH at 1,000 m; 3,280 ft ISA +15 °C, NFH at S/L ISA +10 °C, except where stated):

Max cruising speed:	
NFH	157 kt (290 km/h; 180 mph)
TTH	165 kt (305 km/h; 190 mph)
Econ cruising speed: NFH	
TTH	132 kt (245 km/h; 152 mph)
TTH	140 kt (260 km/h; 162 mph)
Max rate of climb at S/L: NFH	
TTH	528 m (1,732 ft)/min
TTH	522 m (1,713 ft)/min
Rate of climb at S/L, OEI: NFH	
TTH	61 m (200 ft)/min
TTH	45 m (148 ft)/min
Hovering ceiling: IGE: NFH	
TTH	3,140 m (10,300 ft)
TTH	2,960 m (9,720 ft)
OGE: NFH	
TTH	2,515 m (8,260 ft)
TTH	2,355 m (7,720 ft)
Mission loiter: NFH, 50 n miles (93 km; 58 miles) from base, 20 min reserves	
TTH	3 h 20 min

Range: max operational:	
NFH	491 n miles (910 km; 565 miles)
TTH	430 n miles (796 km; 494 miles)
ferry: NFH	658 n miles (1,220 km; 758 miles)
TTH	648 n miles (1,200 km; 745 miles)

Radius of action:	
TTH with 2,000 kg; 4,409 lb payload, 30 min reserves	162 n miles (300 km; 186 miles)
Max endurance: NFH	4 h 45 min
TTH	4 h 35 min

Iran

AII

AVIATION INDUSTRIES OF IRAN

40 Atefi Street, Vali-E-Asr Avenue (PO Box 14195-111), 1967954691 Tehran
Tel: (+98 21) 22 05 23 86 and 22 05 21 69
Fax: (+98 21) 22 05 89 20
e-mail: info@aia-co.com
Web: http://www.aia-co.com
MANAGING DIRECTOR: Hamid Sabbaghi

AII was formed in April 1993. It is affiliated to the Industrial Development and Renovation Organisation (IDRO) of the Iranian Ministry of Industries and Mining to produce, repair and maintain various types of aircraft. Following the AVA-101 glider (designed and built by Paravan Pars, flown in 1995 and now in service with Iran Civil Aviation Training Services), it flew its first powered aircraft, the AVA-202 two-seat trainer, in mid-1997.

In 1998 the company began construction of its own 75 ha (185.3 acre) airport facility at Azadi, some 65 n miles (120 km; 75 miles) from Tehran; this was completed in 2000. An aeroclub and sales centre have been established at this location for pilot training and customer demonstrations.

Under the designation AVA-303, AII is undertaking licensed assembly of the Polish PZL M18B Dromader agricultural aircraft to supplement those already purchased directly from PZL. By the end of 2002 the first set of Polish-supplied components had been received and assembled. The programme is expected to yield 12 to 15 aircraft for the Iranian Ministry of Agriculture, built at a new production line to be located at Azadi.

Other programmes stated to be current in October 2004 included a small helicopter (AVA-505) and a new 19-seat transport (AVA-606), both now to be joint ventures, while the AVA-404 designation will be applied to a foreign type to be produced under licence.

AII's AVA designations appear to be assigned for purposes of unification and export marketing; some of the aircraft are known by different designations within Iran, having been produced by companies affiliated to AII.

AII AVA-202

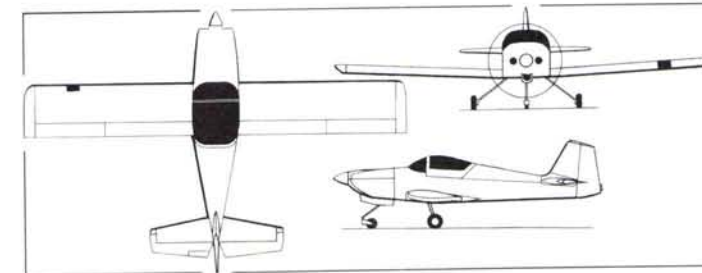
TYPE: Primary prop trainer/sportplane.

PROGRAMME: Intended for domestic market to avoid dependence on foreign imports; prototype (originally known as IR-02) made first flight on 3 June 1997; second had been built by 3 January 1999 when one was lost in a fatal accident while testing an emergency parachute. Series production launched in 2000. Iranian certification to JAR-VLA (Normal category)



AVA-202 trainer/sportplane (Paul Jackson)

1159077



Aviation Industries of Iran AVA-202 trainer (Paul Jackson)

1121600

standard was awarded on 16 August 2000. Made its public debut (fourth aircraft shown) at the Iran International Air Show in October/November 2002. Four completed by early 2003; no later total provided by mid-2006.

CUSTOMERS: Four ordered by a flying school in Iran; 10 on option for a government institute. DESIGN FEATURES: Similar configuration to US Van's RV-6A, but with greater wing span; meets JAR 22 and JAR-VLA standards. Intended for pilot training, general aviation, surveillance and recreational flying.

NASA aerofoil sections: 63-215 (wing), 63-015 (horizontal tail) and 63-010 (vertical tail).

FLYING CONTROLS: Conventional and manual. Balanced ailerons; horn-balanced elevators. Trim tab in port elevator. Electrically actuated single-slotted flaps.

STRUCTURE: Mainly aluminium alloy; steel alloys in some areas. Single-spar wings. Glass fibre engine cowling and wingtip fairings.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring steel tube cantilever mainwheel legs with 5,00-5 tyres; trailing link, castoring nosewheel on spring steel tube cantilever leg with shimmy damper; tyre size 10X3.50-4. Hydraulic mainwheel disc brakes. Streamlined composites fairings over all three wheels.

POWER PLANT: One Textron Lycoming O-320-B2B flat-four engine (119 kW; 160 hp at 2,700 rpm), driving a Sensenich M 74 DM two-blade, fixed-pitch metal propeller. Optional 112 kW (150 hp) Lycoming O-320-E2D. Integral fuel tank in each wing, combined capacity 120 litres (31.7 US gallons; 26.4 Imp gallons).

ACCOMMODATION: Two seats side by side. Dual controls. Wraparound windscreen; one-piece rearward-sliding canopy. Cabin heated and ventilated. Rear baggage compartment with internal access.

SYSTEMS: 12 V electrical system.

AVIONICS: To customer requirements; can include Bendix/King KX 155 VHF nav/com radio, ELT, and ADF/VOR/GPS.

DIMENSIONS, EXTERNAL:

Wing span	8.74 m (28 ft 8 in)
Wing chord, constant	1.24 m (4 ft 0 3/4 in)
Wing aspect ratio	7.0
Length overall	6.02 m (19 ft 9 in)
Height overall	2.04 m (6 ft 8 1/4 in)
Propeller diameter	1.88 m (6 ft 2 in)

AREAS:

Wings, gross	10.87 m ² (117.0 sq ft)
Vertical tail surfaces (total)	1.04 m ² (11.19 sq ft)
Horizontal tail surfaces (total)	2.40 m ² (25.83 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	500 kg (1,102 lb)
Max T-O and landing weight	750 kg (1,653 lb)
Max wing loading	69.0 kg/m ² (14.13 lb/sq ft)
Max power loading	6.29 kg/kW (10.33 lb/hp)

PERFORMANCE:

Max level speed at S/L	140 kt (259 km/h; 161 mph)
Max cruising speed, 75% power	135 kt (250 km/h; 155 mph)
Stalling speed, flaps down	45 kt (84 km/h; 52 mph)
Max rate of climb at S/L	457 m (1,500 ft)/min
Service ceiling	6,400 m (21,000 ft)
T-O run	250 m (820 ft)
Range with max fuel	540 n miles (1,000 km; 621 miles)

AII AVA-303

TYPE: Agricultural sprayer.

PROGRAMME: Assembly and eventual licensed manufacture of PZL M-18B Dromader (which see), to supplement aircraft previously imported from Poland; first set of Polish-supplied components (for EP-AVA, c/n 303-1, delivered 23 September 2002) had been assembled by end of 2002. New assembly line located at Azadi airport facility. Company reported



Iranian-assembled Dromader marked 'AVA303' 1159035

expanded production by early 2005, though no specific details given. Earlier plans to introduce some design changes will not now be implemented.

CUSTOMERS: Iranian Ministry of Agriculture. Programme may yield 12 to 15 new aircraft, depending upon requirement.

All AVA-404

In design stage 1996 as twin-turboprop light transport, but not proceeded with. Designation re-allocated to a new six-seat design, which company now says will be a foreign type manufactured under licence. This had not been identified by mid-2006.

All AVA-606

TYPE: Twin-turboprop light transport.

PROGRAMME: The 19-seat transport project announced by AII in 2002 now has the designation AVA-606. According to the company in October 2004, this is to be a joint venture programme, negotiations with different companies being under way at that time. Three months later, at the Iran Air Show, it exhibited a model of a 19/32-seat passenger transport bearing the designation A-209M and the name of the Austrian-registered company Mukhamedov Flugzeugbau GmbH. AII would not comment further beyond saying that it was close to an agreement with a partner on the concept. No details of the aircraft were forthcoming, and no further news had emerged by mid-2006.

Further details of the A-209M, then credited to the Aero-M design bureau, appeared in *Jane's All the World's Aircraft* between 1997 and 1999.

AIO

AVIATION INDUSTRIES ORGANISATION OF THE ISLAMIC REPUBLIC OF IRAN

107 Gharani Avenue, Tehran
Tel: (+98 21) 881 04 81 to 881 04 87
Fax: (+98 21) 882 50 46
e-mail: aviation-id@isiran-net.com

AIO, a subdivision of the Iranian Ministry of Defence, is the policy maker, co-ordinator and planner for the manufacturing, overhaul, repair and support of aircraft by Iran's aviation industry. Created to counter problems arising from the Gulf wars and subsequent economic sanctions, its primary concern has been in supplying spares for aircraft in service and obtaining the technologies required for manufacturing various types of aircraft for the Iranian armed forces. However, it has now assumed a much greater role in aircraft development and production, including civil programmes such as the Ir-An-140.

According to *Jane's* sources in December 2001, the Iranian government was to consider a bill calling for the establishment of an Aerospace Organisation of the Defence and Armed Forces Logistics Ministry, into which all aerospace manufacturing and research units, as well as Iranian MoD factories, would be merged. No later information regarding this proposal had emerged by mid-2006.

Earlier proposals for a co-production programme involving the Ilyushin Il-114 lapsed, but talks between Iranian officials and the Tupolev JSC have continued concerning possible Iranian participation (including local assembly) in the Tu-204 and manufacture of up to 100 Tu-334s over a 15-year period.

SUBSIDIARIES:

Iran Aircraft Manufacturing Industries (IAMI)
HEAD OFFICE: 5th floor, 107 Gharani Avenue (PO Box 14155-5568), Tehran
Tel: (+98 21) 882 73 75 and 882 83 55



IHSRC Bell 214ST (Robert Hewson) 1121644

Fax: (+98 21) 882 83 55
WORKS: PO Box 83145-311, Shahin Shahr, Esfahan
Tel: (+98 311) 221 42 18
Fax: (+98 311) 221 42 19
e-mail: info@hesaco.com
Web: www.hesaco.com
MANAGING DIRECTOR: Abbas Fallah

Otherwise known as Hevapeimasazi, or **HESA**, this state-owned company is controlled jointly by the Iranian Ministry of Defence and Ministry of Industries and Mining, and is the main aircraft production centre of the AIO, with divisions responsible for trainers, helicopters, the Ir-An-140 transport and UAVs. Programmes include the HT-80, a proposed replacement for (but based on) the Pilatus PC-7 Turbo-Trainer.

Esfahan factory construction initiated 1975 by Bell Helicopter Textron for production of Bell 214, but suspended 1978 after Islamic revolution when only 11 per cent completed. Reactivated 1983; began piston engine manufacture 1988 and Northrop F-5B overhaul 1989. Helicopter (Bell AH-1J and other) and hovercraft overhaul started 1993; first production piston engine completed in 1996.

Following a February 1996 agreement, a factory was set up, with Ukrainian government assistance, for licensed assembly of the Antonov An-140 twin-turboprop transport, now known by the Iranian designation Ir-An-140 Faraz. A similar agreement with MAPO organisation, for manufacture of 60 Motor-Sich TV7-117VMA turboprop engines, was announced at the 1997 Paris Air Show and valued at USD180 million. These engines were said to be for installation on 'Ukrainian- and Russian-built' airliners.

Qods Aviation Industries (QAI)
PO Box 13445-873, 4 Km Karaj Road, Tehran
Tel: (+98 21) 450 33 06
Fax: (+98 21) 450 33 07
e-mail: mohajer@isiran.com

Established 1984 to design, develop and manufacture surveillance/reconnaissance and attack RPV/UAVs and aerial targets (see *Jane's Unmanned Aerial Vehicles and Targets*). Subsidiary of IAMI/HESA. Also manufactures parachutes and parafoils for UAV/target/ultraights recovery, sky-diving and various other applications. Factory area 40,000 m² (430,550 sq ft); 1998 workforce (latest known figure) approximately 400.

Iran Aircraft Industries (IACI)
PO Box 14155-1449, Tehran
Tel: (+98 21) 603 56 06
Fax: (+98 21) 600 00 75
e-mail: karhava@isiran.com
MANAGING DIRECTOR: Nasser Marzabani
AERO-ENGINE PROGRAMMES MANAGER: Eng Amiri

Established by Northrop Corporation in 1970; first Iranian aviation company to obtain ISO 9002 certification. Known locally as **SAHA**, factory has overhauled, maintained and repaired

approximately 4,000 aircraft and aero-engines. Like IAMI/HESA, it is controlled by the Ministry of Defence. It occupies a 45,000 ha (111,195 acre) site, and had a 2004 workforce of about 2,500. It is designated to produce the Tu-204, and the Tu-334 and its D-436 engines, if these programmes come to fruition. Earlier aircraft projects included the Fajr (Dawn) piston-engined trainer described briefly in earlier editions of *Jane's All the World's Aircraft*.

Turbine Engine Manufacturing (TEM)
Manufactures engine components at a 100,000 m² (1.08 million sq ft) site with shop floor area of 33,000 m² (355,200 sq ft). Also has well-equipped research laboratories and active design team. Producer of Toulou 4 and 5 small jet engines, unveiled in late 1999 as power plants for UAVs and aerial targets.

Iran Helicopter Support and Renewal Company (IHSRC)
PO Box 13185-1688, Mehrabad Airport Road, Meraj Avenue, Tehran
Tel: (+98 21) 600 34 14
Fax: (+98 21) 601 58 62
e-mail: panha@isiran.com
MANAGING DIRECTOR: Ahmad Dadbin
DEPUTY MANAGING DIRECTOR: Abdollah Kheirollahi

Established 1969 with assistance of Agusta (Italy) and Bell Helicopter (USA); overhaul and maintenance of Agusta-Bell 205, 212, 214A/B/C; Bell 206/206L, JetRanger/LongRanger and AH-1J/T Cobra series; Boeing CH-47C Chinook; and Sikorsky SH-3D Sea King and RH-53D Sea Stallion. In 1999, it was stated that experience gained with extensive rebuild and refurbishment of AH-1J SeaCobras had given IHSRC (known locally as **PANHA**) the potential for full manufacture, if so required. Current upgrade programmes (see *Jane's Aircraft Upgrades*) include those for Bell 205 (Shabaviz) and AH-1J (Project 2091). PANHA has designed a 14-seat helicopter known as the Parian (fairy in English), possibly based on the Bell 214. By early 2005, this had attracted interest from the National Iranian Oil Company and others; PANHA stated capability to produce up to 20 per year, but no orders reported by mid-2006.

IACI (SAHA) SHAFAGH

English name: The light before dawn
Russian name: Rassvet
TYPE: Advanced jet trainer/light attack jet.
PROGRAMME: Existence revealed at Aero 2000 air show in Tehran; name also transliterated as Safak or Shafag. Programme controlled by Tehran's Aviation University Complex (part of the Malek-Ashtar University of Technology). Design, to IRGC specifications, based on earlier (twin-engined) proposals from Russian OKB headed by Fatinid Mukhamedov, with characteristically unorthodox configuration. Wind tunnel testing of one-seventh scale model in Tehran followed by completion of full-size mockup. Integration of landing gear, hydraulic system and avionics under way in late 2002. Displayed in model form at Iran International Air Show in late 2002, at which time prototype roll-out targeted for 2008. No further details emerged at January 2005 Iranian air show. According to one report during that year, some design changes were under consideration, including an F-16 type 'chin' intake; design authority had passed to Malek-Ashtar University by 2005.
CUSTOMERS: Potentially, Russian Air Forces (to replace Aero L-39 C) and Iranian Air Force.
DESIGN FEATURES: Close-coupled configuration. Circular wing centre-section with pronounced LERX and tapered outer panels; twin outward-canted fins and rudders and (probably all-moving) tailplane halves.
POWER PLANT: One RD-33 turbofan (General Electric J79 turbojet in early design studies).
ACCOMMODATION: Crew of two in tandem; Russian (Zvezda K-36D ?) ejection seats.
AVIONICS: Row of three MFDs; HUD; HOTAS controls on centrally mounted column.
ARMAMENT: Seven external stores stations (one on centreline and three beneath each wing).
DIMENSIONS, EXTERNAL (approx):
Wing span 12 m (39.4 ft)
Length overall 14 m (45.9 ft)



Shafagh model displayed in January 2005 (Robert Hewson) 1121664



Cockpit of IACI Shafagh 1159037



IACI Shafagh full-size mockup 1159036

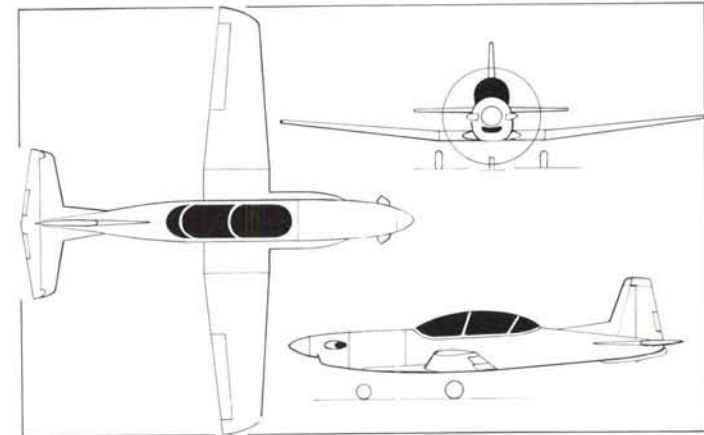
WEIGHTS AND LOADINGS (approx):	
Weight empty	5,000 kg (11,023 lb)
PERFORMANCE (estimated):	
Max level speed	M1.3

IAMI (HESA) HT-80

TYPE: Basic turboprop trainer.
PROGRAMME: Preceded by programme to reverse engineer Pilatus PC-7s under Iranian designation S-68, three prototypes of which completed by Malek-Ashtar University of Technology before being handed over to HESA for series production; latter had reportedly built five before suspending manufacture due to protest from Pilatus. Replaced by HT-80 project, for which in 2002-03 HESA was in conceptual ('pre-preliminary') design stage, as eventual successor to the Swiss trainer in IRIAF service. Roll-out of first example tentatively forecast for 2005 or 2006 at that time, though no further details had emerged by mid-2006. HESA may seek international partners (China one potential option).
CUSTOMERS: S-68s delivered to IRGC (two) and IRIAF.
DESIGN FEATURES: Generally similar to PC-7.
POWER PLANT: Studies in 2002 were based on Walter M601T (flat rated to 559 kW; 750 shp) or equivalent Motor-Sich turboprop, although P&WC PT6A said to be preferred. Four-blade propeller. Capability for 30 seconds of inverted flight.
ACCOMMODATION: Crew of two in tandem on stepped, SKS-94 lightweight ejection seats.
AVIONICS: Conventional (analogue) instrumentation.
Following data estimated and provisional:
DIMENSIONS, EXTERNAL:
Wing span 10.40 m (34 ft 1 1/2 in)
Length overall 9.78 m (32 ft 1 in)
Height overall 3.30 m (10 ft 10 in)
Tailplane span 3.60 m (11 ft 9 3/4 in)
Wheel track 2.60 m (8 ft 6 1/4 in)
Wheelbase 2.32 m (7 ft 7 1/4 in)
WEIGHTS AND LOADINGS (A: Aerobatic, U: Utility category):
Max T-O weight: A 1,900-2,068 kg (4,188-4,559 lb)
U 2,700-2,883 kg (5,952-6,356 lb)



HESA model of the HT-80 Iranian development of the PC-7 (Robert Hewson) 0530184



Provisional general arrangement of the proposed IAMI (HESA) HT-80 turboprop trainer (James Goulding) 0552825

Max landing weight: A	.....	as MTOW
U	.....	2,565–2,733 kg (5,655–6,025 lb)
PERFORMANCE (estimated; A and U as above):		
Max operating speed:	.....	
A	.....	240–324 kt (444–600 km/h; 276–372 mph)
U	.....	270 kt (500 km/h; 310 mph)
Max cruising speed at S/L:	.....	
A, U	.....	208–211 kt (385–391 km/h; 239–243 mph)
Stalling speed: A	.....	71 kt (132 km/h; 82 mph)
U	.....	83 kt (154 km/h; 96 mph)
Max rate of climb at S/L:	.....	
A	.....	702–798 m (2,303–2,618 ft)/min
U	.....	393 m (1,290 ft)/min
Max operating altitude: A, U	.....	7,620 m (25,000 ft)
T-O to 15 m (50 ft) at S/L: A	.....	320–425 m (1,050–1,395 ft)
U	.....	1,180 m (3,870 ft)
Landing from 15 m (50 ft) at S/L:	.....	
A	.....	480–550 m (1,575–1,805 ft)
U	.....	800 m (2,625 ft)
g limits: A	.....	+7.0/–3.5
U	.....	+4.5/–2.5

IAMI (HESA) Ir.An-140 FARAZ

English name: Elevation
TYPE: Twin-turboprop airliner.

PROGRAMME: Licence-built Antonov An-140. Selected by Iran in 1995, against competition from 12 other contenders; initial agreement leading to Iranian manufacture signed February 1996; first stage is assembly from imported KhGAPP CKD kits at rate of up to 12 per year (first two kits received by early 2000); long-term objective is gradual progress to local parts manufacture; Iranian engineers installed at Antonov from 1997. Similar agreement with TEM to assemble power plant. Contract announced late 1998 for initial quantity of 80 aircraft by second quarter 2009, for Iranian domestic (civil and military) use only, but possibility of additional 25 production for export to CIS states has been suggested. In May 1999, Iran Electronics and Leninet (St Petersburg) signed contract for Ir.An-140 avionics development. Assembly of first aircraft (c/n 90-01) began at Esfahan March 1999 and completed by September 2000; maiden flight achieved on 7 February 2001. Second aircraft (of initial batch of eight) rolled out 26 December 2002, maiden flight in March 2003. Iranian certification awarded 14 April 2003. First two aircraft (EP-SFD and 'SFE) handed over to Safiran on 10 October 2003 and began revenue services on 29 November 2004; third completed late 2003 but still unflown by March 2005, at which time two more awaiting acceptance and further three reportedly in final assembly. Fourth aircraft reported to have been completed by time of Dubai Air Show in November 2005, when agreement signed for supply of a further 40 An-140-100 kits, assembly of which scheduled to begin in second quarter of 2010.

Total of 14 originally scheduled for completion from CKD kits by end of 2004, but due to funding delays only three completed at that time. Revised plan called for additional four by March 2006 and next eight by March 2007, with annual output rate of 12 to be achieved in 2008. Offered for passenger (including VIP) civil transport, aeromedical (ambulance or flying hospital) use, cargo/passenger or parachutist carrying, photogrammetry, geosurvey, environmental research, fisheries protection and pollution control; military versions could include staff or personnel transport, coastal and maritime patrol, radar patrol/missile guidance, elint and crew training. MPA to be next version developed; HESA reports IRI Navy requirement for about 10; hoped to roll out first example in 2006.

CURRENT VERSIONS: **Ir.An-140:** First three Iranian-assembled aircraft. *Following description applies to this version.*

Ir.An-140-100: Iranian production switched to this version from fourth aircraft onwards. KhGAPP scheduled to deliver first four CKD kits in 2004; up to 10 supplied or earmarked by mid-2006.

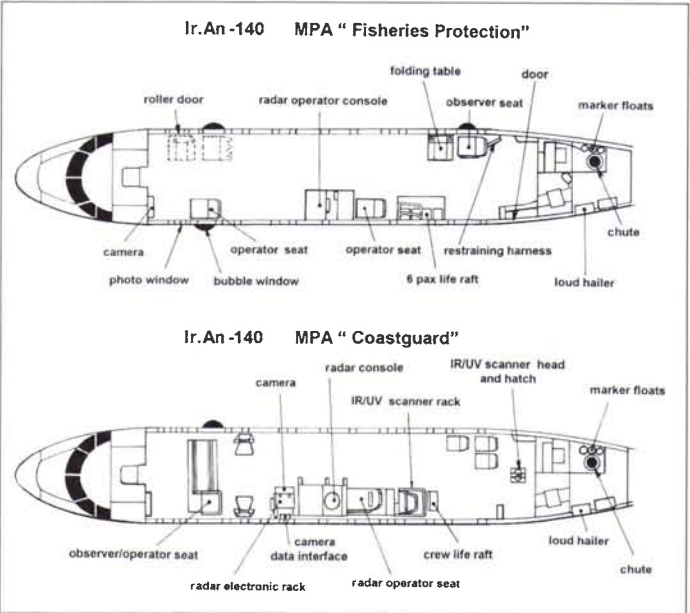
Stretched version: Projected version with 3.80 m (12 ft 5½ in) longer fuselage seating up to 68 passengers; 2,237 kW (3,000 shp) engines, 22,400 kg (49,383 lb) MTOW and 917 n mile (1,700 km; 1,056 mile) range.

Ir.An-140MPA: Maritime patrol version; under collaborative design development with three other companies in 2002–03 (undisclosed, but thought to be KhGAPP, Antonov and Thales). Major changes (based on Ir.An-140-100 airframe) would be: bubble window each side of front fuselage; undernose FLIR turret; ventral search radar; underwing stations for weapons or auxiliary fuel tanks; MAD tailboom; and ESM suite. Internally, cabin configured for up to four systems operator positions. Roles could be extended to ASuV and/or ASW missions.

Ir.An-140T: Military transport; as TC but without rear ramp.

Ir.An-140TC: Tactical transport; under similar collaborative design development to MPA version; planned to be third version developed; rear fuselage redesigned to incorporate rear-loading ramp. Internal capacity for (typically) three 106 mm AA guns, three light vehicles or five LD3 containers; or up to 36 paratroops and a jumpmaster.

CUSTOMERS: Launch customers initially reported as Iran Air and Iran Asseman Airlines, of which latter signed order for 20 in October 1999, but Iran Air later declined to operate the type. Stalled in October 2000 that 'orders' had been received for 127, but these revealed by early 2005 as letters of intent and total reduced to 112. Briefly operated in mid-2003 by Kish Air, first two then being delivered in October 2003 to Safiran Airlines, which has ordered six. Scheduled services with Safiran (Tehran to Gorgan) began 29 November 2004. Seventh aircraft, due to be delivered in 2006, will be first of four ordered by Arvand Air. Estimated Iranian market for 80. Likely also to be procured by Iranian Air Force and Navy (potential roles tactical transport, maritime patrol and EW). Africa regarded as most likely export market.



Interior arrangement of maritime Ir.An-140s (James Goulding)

1121599

COSTS: USD8.5 million unit price (2005); set-up of production line USD273 million.	
POWER PLANT: Two TEM-assembled AI-30 Series 1 (Motor-Sich-built Klimov/ZMKB Progress TV3-117VMA-SBM1) turboprops, each flat-rated at 1,864 kW (2,500 shp) and driving an AV-140 six-blade propeller. First Iranian-assembled engine completed January 2005. Fuel capacity 5,460 litres (1,442 US gallons; 1,201 Imp gallons).	
AVIONICS: Supplied initially by Avio Pribor; Thales (Sextant) suite under negotiation in 2002–03.	
DIMENSIONS, EXTERNAL:	
Wing span	25.505 m (83 ft 8¼ in)
Wing aspect ratio	11.5
Length: overall	22.605 m (74 ft 2 in)
fuselage	22.46 m (73 ft 8¼ in)
Fuselage max diameter	2.82 m (9 ft 3 in)
Height overall	8.23 m (27 ft 0 in)
Elevator span	9.385 m (30 ft 9½ in)
Wheel track (c/l of shock struts)	3.18 m (10 ft 5¼ in)
Wheelbase	8.125 m (26 ft 8 in)
Distance between propeller centres	8.20 m (26 ft 10¾ in)
Propeller diameter	3.72 m (12 ft 2½ in)
Passenger door (rear, port): Height	1.68 m (5 ft 6¼ in)
Width	0.915 m (3 ft 0 in)
Service door (rear, stbd): Height	1.29 m (4 ft 2¾ in)
Width	0.62 m (2 ft 0½ in)
Cargo door (fwd, stbd): Height	1.29 m (4 ft 2¾ in)
Width	0.985 m (3 ft 2¾ in)
Emergency exit (fwd, port): Height	1.18 m (3 ft 10½ in)
Width	0.51 m (1 ft 8 in)
DIMENSIONS, INTERNAL:	
Passenger cabin:	
Length:	
excl galley/lavatory and baggage area	11.60 m (38 ft 0¾ in)
incl galley/lavatory and baggage area	14.51 m (47 ft 7¼ in)
Max width	2.60 m (8 ft 6¼ in)
Width at floor	2.28 m (7 ft 5¾ in)
Aisle width	0.46 m (1 ft 6 in)
Max height	1.90 m (6 ft 2¾ in)
Underfloor cargo hold: Length	3.98 m (13 ft 0¾ in)
Width	1.45 m (4 ft 9 in)
Max depth	0.545 m (1 ft 9½ in)
Baggage/cargo compartment volume:	
rear	6.1 m³ (215 cu ft)
underfloor	3.0 m³ (106 cu ft)
Overhead bins volume (total)	2.3 m³ (81 cu ft)
AREAS:	
Wings, gross	56.36 m² (606.6 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	11,800 kg (26,015 lb)
Max fuel weight	4,370 kg (9,634 lb)
Max payload	6,000 kg (13,228 lb)
Baggage/cargo compartment capacity:	
rear	1,040 kg (2,293 lb)
underfloor	560 kg (1,235 lb)
Max T-O weight	21,500 kg (47,399 lb)
Max landing weight	21,000 kg (46,297 lb)
Max zero-fuel weight	19,200 kg (42,329 lb)
Max wing loading	381.5 kg/m² (78.13 lb/sq ft)
Max power loading	5.64 kg/kW (9.26 lb/shp)
PERFORMANCE:	
Max cruising speed at FL180	288 kt (533 km/h; 331 mph)
Max rate of climb at S/L	420 m (1,378 ft)/min
Service ceiling	7,600 m (24,940 ft)
Max operating altitude	6,250 m (20,500 ft)
T-O distance, 10° flap	1,350 m (4,430 ft)
Landing distance, 40° flap	1,295 m (4,250 ft)
Range at optimum cruising speed, 45 min reserves:	
with 52 passengers	1,112 n miles (2,060 km; 1,280 miles)
with 46 passengers	1,430 n miles (2,650 km; 1,646 miles)
with 34 passengers	1,987 n miles (3,680 km; 2,286 miles)



Production Ir.An-140 in the livery of Safiran Airways (Robert Hewson)

1121658

Ferry range	2,105 n miles (3,900 km; 2,423 miles)
Endurance	6 h
OPERATIONAL NOISE LEVELS (estimated):	
T-O, flyover	85.0 EPNdB
Sideline	82.5 EPNdB
Approach	89.5 EPNdB

IAMI (HESA) SHAHED 278

TYPE: Light utility helicopter.



First production Shahed 278 at Iran Air Show, January 2005 (Robert Hewson) 1121592

PROGRAMME: Three prototypes, first of which made maiden flight late 1997 or early 1998; most-flown prototype had accumulated 200 hours by March 2001. Public debut at Iran International air show in October/November 2002 as HESA 278, having previously been reported as Panha 287. First production aircraft exhibited at Iran Air Show, Kish Island, in January 2005; second and third then undergoing static and fatigue testing, with fourth expected to fly 'soon'.

DESIGN FEATURES: Five-seater; intended for dual military/civil use, though designed primarily to meet military requirements. Locally redesigned Bell 206 JetRanger. Declared improvements include updated transmission; engine particle separator; composites airframe; new, high-efficiency tail rotor blades; new-design horizontal stabiliser; self-sealing fuel tanks; improved cabin comfort, sound insulation and optional air-conditioning; increased-area transparencies. Being marketed by 2005 for training, traffic observation, police and border patrol, rescue, medevac, aerial photography and private operation.

POWER PLANT: One 313 kW (420 shp) Rolls-Royce 250-C20B turboshaft. Fuel capacity 287 litres (75.8 US gallons; 63.1 Imp gallons) in self-sealing tanks.

ACCOMMODATION: Pilot and four passengers in 2+3 arrangement.

WEIGHTS AND LOADINGS:

Weight empty	682 kg (1,504 lb)
Normal T-O weight	1,451 kg (3,198 lb)

PERFORMANCE:

Max level speed: at S/L	129 kt (240 km/h; 149 mph)
at FL50	124 kt (230 km/h; 142 mph)
Max rate of climb at S/L	762 m (2,500 ft)/min
Service ceiling	6,400 m (21,000 ft)
Hovering ceiling: IGE	6,218 m (20,400 ft)
OGE	4,865 m (15,960 ft)
Range	183 n miles (340 km; 211 miles)

DORNA

H F DORNA COMPANY

206th Sarvestan Street (PO Box 16315-345), Pasdaran Avenue, Tehran 16619
Tel: (+98 21) 22 85 48 27
Fax: (+98 21) 22 84 18 31
e-mail (1): info@hfdorna.com
e-mail (2): drna@kavoshinet
Web: www.hfdorna.com
MANAGING DIRECTOR: Yaghoob Antesary
CHIEF DESIGNER: Mohammad Hassan Karami

Company established March 1989 to specialise in aircraft design and development, and in composites materials technology. It has 3,000 m² (32,300 sq ft) of factory space and had a workforce of 60 in July 2005. Current product is two-seat Blue Bird. Dorna planned to open a private pilot flying training school, equipped with Blue Bird, during 2006. In 2005-06, it was seeking investors in a new light utility twin-turboprop design.

DORNA D-139 BLUE BIRD

TYPE: Two-seat lightplane.

PROGRAMME: Launched 1994; prototype manufacture started mid-1994; first flight was made on 27 July 1998; prototype had accumulated 600 hours' flying in 800 flights by end of November 2005. Certification to JAR 21 standards by the Iranian CAO was awarded on 2 December 2001, and initial production is under way. Improved version, characterised by forward-hinged doors, was scheduled for certification in early 2005; received amendment to Type Certificate for yoke or stick type control system.

CUSTOMERS: First five production aircraft sold to Iranian civil aeroclubs for pilot training; manufacture of these began in 2001. Stated orders for 14 and options for 30 more as at March 2006.

COSTS: Programme cost by November 1998 estimated at USD1.5 million excluding R&D; basic aircraft quoted at USD137,500 for new version (2006).

DESIGN FEATURES: Conventional low-wing, fixed-gear lightplane, designed for low-cost, easy-to-fly/maintain operation.

Several revisions of detail during early production including enlarged engine cowling for improved cooling (achieved in at least two stages of modification); tailplane leading-edge root extensions; enlarged rudder horn balance; fluted (bead) skin on rudder and ailerons. By 2004, all these features applied to new version having forward-hinged doors in place of previous 'gull wing' type. At least one aircraft of earlier version noted with flaps of reduced span.

Wings have constant chord, NACA 63-215 aerofoil section, 2° 30' dihedral from roots, 2° incidence and -2° twist.

FLYING CONTROLS: Conventional and manual; yoke or stick available optionally. Ailerons and elevators actuated by pushrods; rudder by cables; elevators have electric trim. Electrically actuated plain flaps.

STRUCTURE: All-composites. Two-spar wing, single-spar horizontal tail, monocoque fuselage. LANDING GEAR: Non-retractable tricycle type, with Goodyear 5.00-5 tyres (6 ply on mainwheels, 4 ply on nosewheel). Fuselage-mounted cantilever self-sprung steel leg on each unit. Cleveland mainwheel brakes. Composites speed fairings on all three wheels.



Dorna Blue Bird cockpit details 1159039

POWER PLANT: One 84.6 kW (113.4 hp) Rotax 914 F3 flat-four engine driving an MT Propeller; three-blade MTV-6-A/172-08 variable-pitch propeller at 5,800 rpm. Fuel tank in each wing, combined capacity 120 litres (31.7 US gallons; 26.4 Imp gallons); gravity filling point on each tank. Oil capacity 3.0 litres (0.8 US gallon; 0.7 Imp gallon).

ACCOMMODATION: Two seats side by side, with baggage compartment aft of seats. Initially with narrow hardtop roof to cabin; access via upward-opening window each side, each with smaller non-opening window to rear. Later aircraft have full-height, forward-hinged door each side.

SYSTEMS: Electrical system: 12 V 20 A integral AC generator, 12 V 40 A external alternator and 35 Ah battery.

AVIONICS: Comms: Bendix/King KX 125 nav/com; KT 76A transponder.

Instrumentation: Conventional VFR.

DIMENSIONS, EXTERNAL:

Wing span	9.45 m (31 ft 0 in)
Wing chord, constant	1.17 m (3 ft 10 in)
Wing aspect ratio	8.1
Length overall	6.17 m (20 ft 3 in)
Fuselage max width	1.12 m (3 ft 8 in)
Height overall	2.17 m (7 ft 1½ in)
Tailplane span	2.70 m (8 ft 10¼ in)
Wheel track	1.94 m (6 ft 4½ in)
Wheelbase	1.51 m (4 ft 11½ in)
Propeller diameter	1.72 m (5 ft 7¾ in)
Propeller ground clearance	0.18 m (7 in)

DIMENSIONS, INTERNAL:

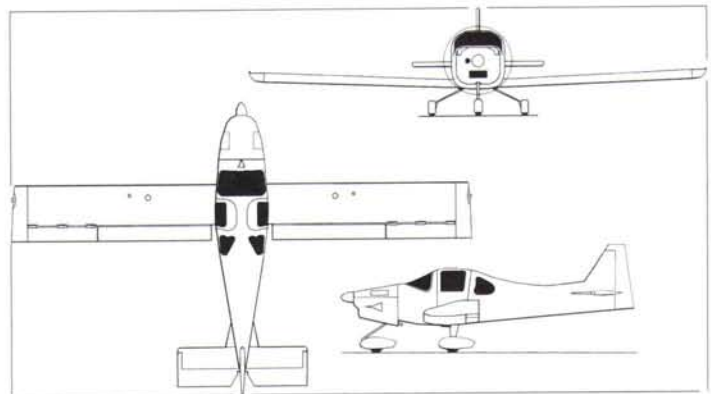
Cockpit: Length	1.09 m (3 ft 7 in)
Max width	1.02 m (3 ft 4¼ in)



Current versions of Dorna Blue Bird, showing larger doors 1159038



Dorna Blue Bird cockpit with optional control sticks 1159040



Dorna Blue Bird (Rotax flat four piston engine) (Paul Jackson) 1128988

AREAS:	
Wings, gross	11.06 m ² (119.0 sq ft)
Ailerons (total)	0.95 m ² (10.23 sq ft)
Trailing-edge flaps (total)	1.54 m ² (16.58 sq ft)
Fin	0.42 m ² (4.52 sq ft)
Rudder	0.37 m ² (3.98 sq ft)
Tailplane	0.84 m ² (9.04 sq ft)
Elevators (total)	0.515 m ² (5.54 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped	490 kg (1,080 lb)
Max fuel weight	90 kg (198 lb)
Max T-O and landing weight	750 kg (1,653 lb)
Max wing loading	67.8 kg/m ² (13.89 lb/sq ft)
Max power loading	8.87 kg/kW (14.58 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	173 kt (321 km/h; 200 mph)

Max level speed at FL140	152 kt (282 km/h; 175 mph)
Max cruising speed at FL100	130 kt (241 km/h; 150 mph)
Econ cruising speed at FL120	87 kt (161 km/h; 100 mph)
Stalling speed at S/L, flaps down	45 kt (83 km/h; 51 mph)
Max rate of climb at S/L	229 m (750 ft)/min
Service ceiling	4,265 m (14,000 ft)
T-O run	275 m (900 ft)
Landing run	244 m (800 ft)
Range with max fuel	590 n miles (1,094 km; 680 miles)

DORNA 12/19-SEAT TRANSPORT

TYPE: Twin-turboprop light transport.
PROGRAMME: In 'final stage of conceptual design' March 2005; offered to potential investors as sale or transfer of design; aimed at developing countries.
DESIGN FEATURES: Designed to EASA standards; operable in ISA +30°C (86 F) conditions; ability to take off and land using sandy or grass airstrips.
STRUCTURE: Composites.
LANDING GEAR: Tricycle type; fixed or retractable.
POWER PLANT: Two turboprops, of Eastern or Western origin; three-blade constant-speed propellers with reverse pitch.
ACCOMMODATION: Flight crew of two plus 12 to 19 passengers (three-abreast seating) or equivalent cargo. Crew door, passenger door and large rear cargo door.
SYSTEMS: Include air conditioning, heating and de-icing.
AVIONICS: To FAR Pt 135A standard; dual controls; full IFR autopilot optional.

Following data all provisional:	
DIMENSIONS, EXTERNAL:	
Wing span	19.51 m (64 ft)
Length overall	14.63 m (48 ft)
Height overall	5.49 m (18 ft)
DIMENSIONS, INTERNAL:	
Passenger cabin: Length	6.10 m (20 ft)
Max width	1.83 m (6 ft)
Max height	1.68 m (5.5 ft)
WEIGHTS AND LOADINGS:	
Max cargo payload	2,041 kg (4,500 lb)
Max T-O weight	7,257 kg (16,000 lb)
PERFORMANCE (estimated):	
Cruising speed at FL120	216 kt (400 km/h; 249 mph)
Max rate of climb at S/L	550 m (1,804 ft)/min
Service ceiling, OEI	3,050 m (10,000 ft)
Range:	
with 2,000 kg (4,409 lb) payload	243 n miles (450 km; 279 miles)
with 900 kg (1,984 lb) payload	647 n miles (1,200 km; 745 miles)



Dorna's projected 12/19-seat civil transport 1044760

FACI
FAJR AVIATION AND COMPOSITES INDUSTRY

Km 5, Karaj Road, PO Box 13445-885, Tehran
Tel: (+98 21) 465 94 61
Fax: (+98 21) 465 94 60
e-mail: fac@fajr-ind.com
Web: www.fajr-ind.com
GENERAL DIRECTOR: E Ghaleh

FACI established 1991 by Raht-Aseman Co (www.raht-air.com), which remains F-3 exclusive distribution agency, with objective of developing all-composites aircraft in Iran. Plant has 30,000 m² (323,000 sq ft) site at Mehrabad International Airport with 6,500 m² (69,965 sq ft) of hangar space and 3,600 m² (38,750 sq ft) of other covered space; total workforce is 130. Its first design, the F-3, entered production in 2001 and made its public debut in October 2002. Production continuing in 2006, now of improved F-3B.

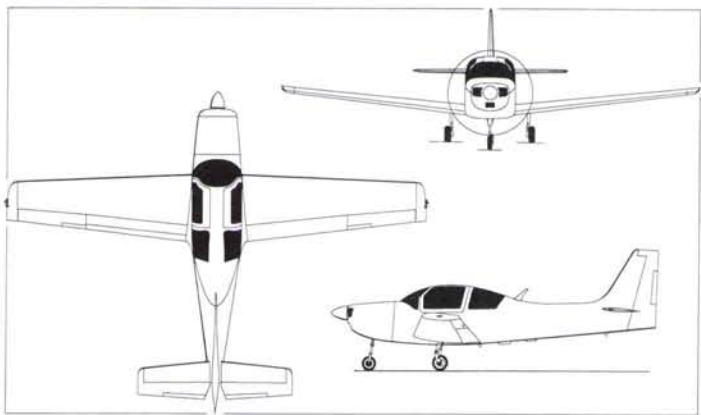
FACI FAJR F-3

English name: Dawn
TYPE: Four-seat lightplane.
PROGRAMME: Design began 1992; construction of prototype started 1993; first flight 26 January 1995; further airframe for static testing; JAR 23-standard domestic type certificate awarded September 2000; construction of first production aircraft (now Fajr F-3A) began 2001; first deliveries 2002. Development plans so far announced include introduction of retractable landing gear (Fajr F-3B, certified in 2004) and some weight reduction measures to improve cruise performance.
CUSTOMERS: Domestic orders for 20 by January 2003. Five reportedly completed by that time, of which two then delivered; a sixth had been completed by November 2004. Ordered by Iranian Border Patrol, which is reported to have requirement for 10.



Fajr F-3 assembly line 1113677

DESIGN FEATURES: Intended for pilot training and utility roles. Designed for low cost and easy maintenance.
Horstmann-Quast HQ-42E advanced laminar aerofoil section, with thickness/chord ratio of 16 per cent and 2° 17' sweepback, Dihedral 6° 30' from roots; twist -2° 30'; incidence 2° 18'. Raked wingtips.
FLYING CONTROLS: Conventional and manual (push/pull rods). Horn-balanced ailerons, elevators and rudder, each with inset tab (ground-adjustable on ailerons, electrically actuated on elevators and rudder). Electrically actuated single-slotted Fowler flaps. Deflection angles: ailerons +22/-15°; elevators +30/-25°; rudder ±30°, flaps +15/-40°; rudder and elevator trim tabs ±25°.
STRUCTURE: All-composites; monocoque fuselage; high-stress parts of glass fibre airframe are reinforced with carbon fibre. Wings and horizontal tail, including control surfaces, are two-spar (I and C section) structures primarily of glass fibre/epoxy/foam sandwich shells. Two-piece monocoque fuselage of similar construction, with unidirectional carbon fibre reinforcement; embedded longerons; integral fin; Kevlar cowlings.
LANDING GEAR: Tricycle-type; fixed on first few aircraft; now also retractable. Goodyear tyres: size 15x6.00-6 (main) and 5.00x5 (6 ply) (nose); pressures 4-41 bar (64 lb/sq in) and



General arrangement of the FACI F-3A 0110841

3.38 bar (49 lb/sq in) respectively. Nose gear is steerable ($\pm 18^\circ$) through a mechanical linkage to the rudder pedals. Parker Hannifin brakes are direct-operation, hydraulically actuated disc type. Minimum ground turning radius 2.75 m (9 ft 0¼ in).

POWER PLANT: One Textron Lycoming AEIO-540-L1B5D flat-six engine, flat rated at 201 kW (270 hp), driving a three-blade Hoffmann HOV 123K-KV-K200-AH constant-speed propeller. Fuel capacity 212 litres (56.0 US gallons; 46.6 Imp gallons) standard; 292 litres (77.1 US gallons; 64.2 Imp gallons) optional. Oil capacity 15.1 litres (4.0 US gallons; 3.3 Imp gallons).

ACCOMMODATION: Four persons, in pairs. Dual controls. Two upward-hinged window/doors of glass fibre. Cabin heated and ventilated.

SYSTEMS: 24 to 28 V DC electrical system powered by Gill 70 A 10 Ah alternator. Oxygen system.

AVIONICS: IFR or VFR, to customer's requirements. Options include Bendix/King VHF com, ADF and GPS.

DIMENSIONS, EXTERNAL:

Wing span	10.50 m (34 ft 5½ in)
Wing chord: at root	1.76 m (5 ft 9¼ in)
mean aerodynamic	1.40 m (4 ft 7 in)
at tip	0.94 m (3 ft 1 in)
Wing aspect ratio	7.9
Length overall	8.07 m (26 ft 5¼ in)
Height overall	3.05 m (10 ft 0 in)
Tailplane span	3.87 m (12 ft 8¼ in)

Wheel track	2.08 m (6 ft 10 in)
Wheelbase	1.78 m (5 ft 10 in)
Propeller diameter	2.10 m (6 ft 10¾ in)
Propeller ground clearance	0.175 m (7 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	2.18 m (7 ft 1¾ in)
Max width	1.25 m (4 ft 1¼ in)
Max height	1.53 m (5 ft 0¼ in)
AREAS:	
Wings, gross	14.02 m² (150.9 sq ft)
Ailerons (total, incl tabs)	0.46 m² (4.95 sq ft)
Flaps (total)	0.95 m² (10.23 sq ft)
Fin	2.33 m² (25.08 sq ft)
Rudder (incl tab)	0.91 m² (9.80 sq ft)
Tailplane	2.95 m² (31.75 sq ft)
Elevators (total, incl tabs)	1.16 m² (12.49 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	1,100 kg (2,425 lb)
Max fuel weight: standard	141 kg (311 lb)
optional	204 kg (450 lb)
Max T-O and landing weight	1,580 kg (3,483 lb)
Max wing loading	112.7 kg/m² (23.08 lb/sq ft)
Max power loading	7.85 kg/kW (12.90 lb/hp)
PERFORMANCE (A: fixed gear, B: retractable gear):	
Never-exceed speed (VNE): A, B	200 kt (370 km/h; 230 mph)
Max cruising speed: A	148 kt (274 km/h; 170 mph)
B	175 kt (324 km/h; 201 mph)
Cruising speed at 75% power: A	128 kt (237 km/h; 147 mph)
B	148 kt (274 km/h; 170 mph)
Stalling speed, power off:	
flaps up: A, B	67 kt (125 km/h; 78 mph)
flaps down: A, B	56 kt (104 km/h; 65 mph)
Max rate of climb at S/L: A	280 m (920 ft)/min
B	314 m (1,030 ft)/min
Service ceiling: A	5,180 m (17,000 ft)
B	5,790 m (19,000 ft)
T-O run: B	310 m (1,020 ft)
T-O to 15 m (50 ft): A, B	630 m (2,070 ft)
Landing from 15 m (50 ft): A, B	720 m (2,365 ft)
Landing run: B	330 m (1,085 ft)
Range, standard fuel: A	502 n miles (930 km; 577 miles)
B	702 n miles (1,300 km; 807 miles)
Endurance: A	4 h 30 min
B	6 h
g limits: A, B	+4.4/-1.76

IRGC
IRAN REVOLUTIONARY GUARD CORPS

Development of the Shahed 274 helicopter is reported to have been undertaken by the Pasdaran, or Revolutionary Guards.

IRGC SHAHED 274

TYPE: Light utility helicopter.

PROGRAMME: Sponsored (as X-5) by the Institute of Industrial Research and Development of the IRGC; reportedly due to have made its first flight in 1997. First aircraft (71-832) handed over to IRGC 16 September 1999. International public debut, in Tehran, 30 December 2000. At least two more (74-001 and '002) in service by end of 2001. Further public appearance in air show on Kish Island, October/November 2002. Current status still uncertain in 2006.

CUSTOMERS: Total of 20 (other sources suggest 30) were reportedly planned to be built by end of 2004, but no evidence of these seen by mid-2006.

DESIGN FEATURES: Two-blade main and tail rotors; fully enclosed cabin and tailboom; upper and lower vertical fins. Intended applications include observation, rescue and light cargo-carrying.

LANDING GEAR: Twin-skid type.

POWER PLANT: One 313 kW (420 shp) Rolls-Royce 250-C20B turboshaft.

ACCOMMODATION: Seats for five persons including pilot. Forward-opening crew door and passenger door each side; baggage door aft of latter on port side.

Following data provisional and unconfirmed.

DIMENSIONS, EXTERNAL:

Main rotor diameter	10 m (33 ft)
---------------------	--------------



First photograph released of the Shahed 274 five-seat helicopter (Aviation Industries Journal of Iran) 0095152

Fuselage length	9 m (30 ft)
Height overall	3 m (10 ft)
WEIGHTS AND LOADINGS:	
Weight empty	1,000 kg (2,200 lb)
Max T-O weight	1,500 kg (3,300 lb)
PERFORMANCE:	
Max level speed	97 kt (180 km/h; 112 mph)
Ceiling	5,200 m (17,060 ft)
Max range	324 n miles (600 km; 372 miles)

IRIAF
ISLAMIC REPUBLIC OF IRAN AIR FORCE
(YA HOSSEIN PROJECT/OWJ INDUSTRIAL COMPLEX)
PO Box 13885-193, Mehrabad Airport, Tehran
Tel: (+98 21) 452 08 10
Tel/Fax: (+98 21) 452 08 53
CHIEF DESIGNER, TAZARVE: Mahmood Bayat

The Owj Industrial Complex, is an agency of the Iranian MoD and IRIAF established in the early 1990s. Its activities have included design and development of various aircraft components and subsystems in both metal and composites, plus assorted ground equipment. It is now understood to have overseen the abortive Azarakhsh fighter programme previously attributed to IAMI (HESA), its intended production centre, and is currently responsible for development of the Saeghe attack fighter.

The IRIAF's Ya Hossein Project has yielded the Tazarve jet trainer, which made its first flight in 2001 and its public debut at the end of 2002.

IRIAF (OWJ) AZARAKHSH

English name: Lightning
TYPE: Attack fighter.

Aircraft, and any news of progress, were absent from Iranian air show in November 2002. Reported in late 2003 that AIO had announced plans during that year to begin low-rate series production of up to 30, but aircraft again absent from second Iranian air show in January 2005. No evidence at that time that any more than six prototypes, at most, had been completed, and programme now generally believed to have been abandoned.

IRIAF (OWJ) SAEGHE

English name: Lightning
TYPE: Attack fighter.

PROGRAMME: Said to have been designed at Owj Industrial Complex, replacing abortive Azarakhsh programme, Modified Northrop F-5E, rebuilt in twin-finned configuration and probably incorporating experience gained in Project Simorgh work on building new fuselage sections to convert in-country F-5As into two-seat F-5Bs. Photo of model shown



Saeghe (foreground) in formation with an IRIAF F-5F during military exercises in August/September 2006 1165074

on Iranian Students' News Agency website in 2003. First Saeghe airframe reportedly about 70 per cent complete by November 2002 and expected to be completed within next six months. Reported by Iranian news agency as having made its maiden flight on 8 July 2004, although other sources give 30 May 2004 as true date. Name has also been transliterated as Sa'eqeh-80. Flight testing still in progress at end of 2005, attaining speeds approaching Mach 1.

IRIAF (YA HOSSEIN) TAZARVE

English name: Eagle
TYPE: Basic jet trainer.
PROGRAMME: First design studies early 1990s, leading to first prototype (named *Dorna*: crane), flown in or about 1995; substantially redesigned second prototype (*Tondar*: thunder) flown 1998, leading to further wing and fuselage refinements; Tazarve is third (and reportedly final) configuration, embodying further wing, fuselage and systems improvements; manufacture began 1998 and first flight said to have taken place in mid-2001; public debut October/November 2002 at airshow on Kish Island, in full IRIAF insignia and wearing unexplained code 778-2 on vertical fin. Designation JT2-2 has been linked with this aircraft. Fourth prototype under construction at that time and said to have flown by end of 2005; reports that this bears name *Ra'ad* and has slightly sweptback horizontal tail surfaces.
CUSTOMERS: Under development for IRIAF, which ordered five pre-series aircraft for delivery by 2005 and planned acquisition of 25 production examples thereafter.
DESIGN FEATURES: Intended to provide basic, advanced and lead-in fighter training, with secondary capability for light attack. Low/mid-mounted wings, lateral air intakes, conventional sweptback tail unit. Designed for 6,000 hour operational life.



Ya Hossein Tazarve in 2004 colour scheme 1113701

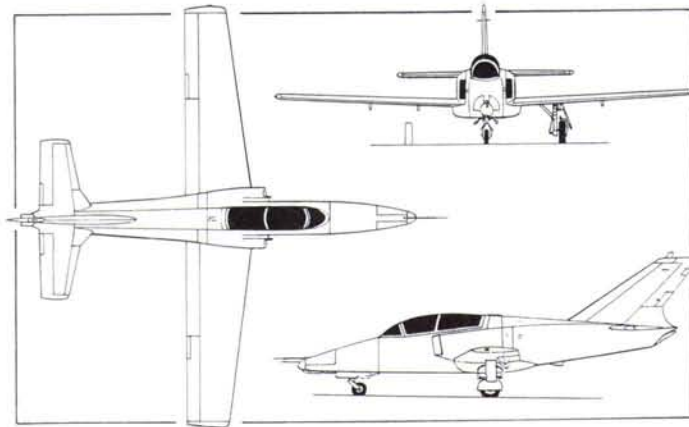
PARAVAR PARS

PARAVAR PARS COMPANY
PO Box 16353-433, Telo Road, 13 km Babae Expressway, Tehran
Tel: (+98 21) 731 41 31, 742 97 24 and 734 96 39
Fax: (+98 21) 731 41 30 and 734 96 39
e-mail: info@paravar-pars.com
Web: www.paravar-pars.com

Company began designing light aircraft in 1992 and first product was **P-72 Nasim** two-seat, all-composites sailplane, which also designated AVA-101 by AII. Became first Iranian company to obtain a sailplane type certification and first in aerospace with product organisation approval; currently (2005) preparing for design organisation approval. Designed and flew (April 2000) Saba motor glider and also produces other ultralight aircraft under licence:
Salar: Flex-wing trike, comprising wing built under licence from General Aircraft Company of Ukraine and tandem-seat pod licensed by Aquilair of France.
Pelican Sport 450: High-wing ultralight; to be produced in Iran as version of Ultravia Pelican of Canada.
Gyroplane: South African Chayair Sycamore two-seat autogyro (which see).

PARAVAR PARS SABA

TYPE: Motor glider.
PROGRAMME: Design began June 1997; prototype made maiden flight April 2000. Promotion continuing in 2006.
DESIGN FEATURES: Low/mid-wing monoplane with T tail.
Eppler wing sections: 654 at root, 434 at tip. Dihedral 2° 30'.
FLYING CONTROLS: Differential ailerons; Hütter two-plate upper and lower surface airbrakes; plain flaps; fixed incidence tailplane, with trim tab in port elevator. Adjustable rudder pedals.



Provisional general arrangement of the IRIAF Tazarve (Michael Badrocke) 0567875

FLYING CONTROLS: Hydraulically boosted ailerons, elevators and rudder; hydraulic flaps with push/pull rod controls.
STRUCTURE: Mainly GFRP/nickel sandwich and carbon fibre. Wings, fuselage and tail sections built as single pieces and bolted together; wing and tail structures resin-bonded. All load-bearing elements of main structure are carbon fibre; parts such as fairings, panels and doors are of GFRP. Nickel layer is sandwiched within composites for protection against lightning strikes and static electricity. MIL-SPEC design criteria applied throughout.
LANDING GEAR: Ya Hossein tricycle type; retractable (nosewheel rearward, mainwheels inward into engine intake trunks).
POWER PLANT: One 12.68 kN (2,850 lb st) General Electric J85-GE-17 non-afterburning turbojet in prototypes; alternative such as Honeywell TFE731-2A turbofan being sought for production aircraft. Fuel capacity 704 kg (1,552 lb) in wing tanks and 300 litres (79.3 US gallons; 66.0 Imp gallons) in fuselage tanks. Provision for two 246 litre (65.0 US gallon; 54.1 Imp gallon) inboard and two 100 litre (26.4 US gallon; 22.0 Imp gallon) outboard underwing auxiliary tanks.
ACCOMMODATION: Crew of two in tandem on Martin-Baker Mk 15 ejection seats; rear seat elevated. Wraparound windscreen; one-piece framed canopy, with built-in MDC, opening sideways to starboard. Accommodation fully pressurised and air conditioned.
AVIONICS: *Comms:* Locally produced UHF/VHF radio.
Instrumentation: Includes VOR, ILS, DME, ADF and Tacan, sourced from inventory stores for aircraft such as F-4 and PC-7.
ARMAMENT: Four underwing attachment points for weapons, drop-tanks or other stores.
DIMENSIONS, EXTERNAL:
Wing span 8.04 m (26 ft 4½ in)
Length overall 10.70 m (35 ft 1¼ in)
Height overall 3.63 m (11 ft 11 in)
WEIGHTS AND LOADINGS:
Weight empty 2,550 kg (5,622 lb)
Max T-O weight 4,000 kg (8,818 lb)
PERFORMANCE:
Max level speed at 5,485 m (18,000 ft) 350 kt (648 km/h; 402 mph)
Stalling speed 85 kt (158 km/h; 98 mph)
Service ceiling 11,582 m (38,000 ft)
T-O run 600 m (1,970 ft)
Landing run 650 m (2,135 ft)
Max range: internal fuel 405 n miles (750 km; 466 miles)
internal and external fuel 600 n miles (1,111 km; 690 miles)
g limits +8.0/-3.8



Salar flex-wing trike marketed by Paravar Pars 1121624

STRUCTURE: Single-spar wings with shells of glass fibre and PVC foam sandwich, carbon fibre spar caps and glass fibre/foam sandwich shear web; detachable for transportation and storage. Metal airbrakes. Flaps and ailerons of GRP/PVC foam sandwich. Glass fibre fuselage and integral fin, of GRP/honeycomb sandwich, reinforced with four carbon fibre longerons.
LANDING GEAR: Tailwheel type; Mainwheel tyres 5.00-5, with Tost hydraulic disc brakes; fully casting tailwheel.
POWER PLANT: *Saba A:* One 59.6 kW (79.9 hp) Rotax 912 flat four, driving a Hoffmann two-blade fixed-pitch propeller.



Paravar Pars Saba side-by-side motor glider

1121628

Saba B: One 84.6 kW (113.4 hp) Rotax 914 flat four, driving a Hoffmann two-blade constant-speed propeller.

Fuel in two rigid tanks in wings, combined capacity 80 litres (21.1 US gallons; 17.6 Imp gallons).

ACCOMMODATION: Two seats side by side. Dual controls standard. Two-piece, gull-wing canopy, opening upward; canopy emergency release standard.

AVIONICS: VFR instrumentation standard.

DIMENSIONS, EXTERNAL:

Wing span	17.25 m (56 ft 7¼ in)
Wing aspect ratio	16.0
Length overall	7.66 m (25 ft 1½ in)
Height over tail	1.77 m (5 ft 9¾ in)

AREAS:

Wings, gross	18.54 m² (199.6 sq ft)
Vertical tail surfaces (total)	1.95 m² (20.99 sq ft)
Horizontal tail surfaces (total)	2.54 m² (27.34 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: both	542 kg (1,195 lb)
Max T-O weight: both	780 kg (1,719 lb)
Max wing loading: both	41.9 kg/m² (8.58 lb/sq ft)
Max power loading: A	13.09 kg/kW (21.51 lb/hp)
B	9.22 kg/kW (15.15 lb/hp)

PERFORMANCE:

Max cruising speed: A	127 kt (234 km/h; 146 mph)
B	135 kt (250 km/h; 155 mph)
Stalling speed: A	41 kt (75 km/h; 47 mph)
B	44 kt (80 km/h; 50 mph)
Max rate of climb at S/L: A	214 m (702 ft)/min
B	237 m (778 ft)/min
T-O to 15 m (50 ft): A	305 m (1,000 ft)
B	295 m (970 ft)
Range with max fuel: both	216 n miles (400 km; 248 miles)
g limits: both	+5.3/-2.65

Israel

IAI

ISRAEL AIRCRAFT INDUSTRIES LTD

Ben-Gurion International Airport, IL-70100 Tel-Aviv

Tel: (+972 3) 935 31 11

Fax: (+972 3) 935 85 16

Web: www.iai.co.il

CHAIRMAN: Ori Orr

PRESIDENT AND CEO: Moshe Keret

EXECUTIVE VICE-PRESIDENT AND COO: Ovadia Harari

CORPORATE VICE-PRESIDENT: Menham Shmul (General Manager, Military Aircraft Group)

DEPUTY CORPORATE VICE-PRESIDENT: Dr David Harari (Director, Research and Development)

DEPUTY CORPORATE VICE-PRESIDENT, MARKETING: Shimon Eckhaus

DIRECTOR OF CORPORATE INDUSTRIAL SERVICES: Menham Tadmor

DEPUTY CORPORATE VICE-PRESIDENT, COMMUNICATIONS: Doron Suslik

Tel: (+972 3) 935 85 09

Fax: (+972 3) 935 85 12

e-mail: hpaz@hdq.iai.co.il

Founded 1953 as Bedek Aviation; ceased being unit of Ministry of Defence and became government-owned corporation 1967; name changed to Israel Aircraft Industries 1 April 1967; number of divisions reduced from five to four February 1988 (Aircraft, Electronics, Technologies and Bedek Aviation). Further restructuring 1994 and now comprises four independent operating Groups: Commercial Aircraft, Military Aircraft, Bedek Aviation and Electronics. Covered floor space 680,000 m² (7.32 million sq ft); total workforce 14,500 in August 2001, of whom one-third are engineers or academics. IAI has ISO 9001 certification, and its products and technologies are fully backed by integrated logistic support, training and a complete after-sales service.

Approved as repair station and maintenance organisation by Israel Civil Aviation Administration, US Federal Aviation Administration, UK Civil Aviation Authority and Israel Air and Space Force. Products include aircraft of own design; in-house produced airframe

systems and avionics; service, upgrading and retrofit packages for civil and military aircraft and helicopters; other activities include space technology, missile and ordnance development, and seaborne and ground equipment.

Sold Galaxy Aerospace to General Dynamics on 1 May 2001, this becoming part of Gulfstream. Renamed Israel Aerospace Industries on 6 November 2006.

IAI comprises four principal divisions:

BEDOK AVIATION GROUP: Provides total aircraft, engine and component repair, overhaul, retrofit, modification, conversion and support services to airlines and leasing companies. On 21 February 2002, IAI and Hindustan Aeronautics Limited of India signed a co-operation agreement for HAL to participate in Bedek's Boeing 737 freighter conversion programme.

MILITARY AIRCRAFT GROUP: Develops and manufactures unmanned air vehicles; integrates and upgrades military fixed-wing aircraft and helicopters; designs and manufactures helicopter structures, electrical harnesses and crash-attenuating aircraft seats.

ELECTRONICS GROUP: Specialises in electronics, electro-optical and inertial systems, and components for military and commercial applications.

COMMERCIAL AIRCRAFT GROUP: Described separately.

COMMERCIAL AIRCRAFT GROUP

Ben-Gurion International Airport, IL-70100 Tel-Aviv

Tel: (+972 3) 935 33 37 and 935 71 49

Fax: (+972 3) 935 42 26

GENERAL MANAGER: M Boness

Established 1994. Design, development, certification and manufacture of civil aircraft; hydraulic, electromechanical and pneumatic components; dynamic systems; and composites material structures (all backed by full computer-aided design, engineering and manufacturing processes).

Gulfstream 100 (formerly IAI Astra) and Gulfstream 200 (formerly IAI Galaxy) are built in Israel and delivered to US for outfitting and sale. Gulfstream 150 received joint Israeli and FAA certification on 7 November 2005.

URBANAERO

URBAN AERONAUTICS LTD

PO Box 190, Airport City, Ben-Gurion Airport, IL-70151 Tel-Aviv

Tel: (+972 3) 683 57 98

Fax: (+972 3) 518 76 45

e-mail: info@urbanaero.com

Web: www.urbanaero.com

CHAIRMAN: Ovadia Harari

PRESIDENT AND CEO: Dr Rafi Yoeli

VICE-PRESIDENT, MARKETING: Janina Frankel-Yoeli

Company formed in 2000 (previously known as Romeo Yankee Ltd), specifically to develop certified VTOL urban aerial vehicles. Currently has completed CityHawk technology demonstrator; has also begun to develop X-Hawk (civil and military variants), as well as unmanned derivatives. Purdy Corporation is a risk-sharing partner, responsible for developing the X-Hawk transmission system. Agreement with Bell Helicopter in August 2005 covered promotion of X-Hawk for US military requirements, plus systems integration and production, if ordered. In 2006, Bell trademarked Fancraft for the technology required for this class of air vehicle.

URBANAERO X-HAWK

TYPE: Lifting vehicle.

PROGRAMME: Commercial derivative of CityHawk.

CURRENT VERSIONS: Planned, FAA-certified (Powered Lift category) **commercial aerial utility** vehicle with modular payload bay and twin turboshaft engines; *as described*. Funding being sought for prototype construction. First phase three-axis wind tunnel testing in both hover and forward flight mode were completed successfully at the University of Arizona in Tucson in August 2005, using a one-tenth scale model; these indicated a maximum attainable speed of at least 130 kt (240 km/h; 149 mph) for the full-scale production X-Hawk. Two Honeywell LTS 101-B2 engines have been ordered for the first

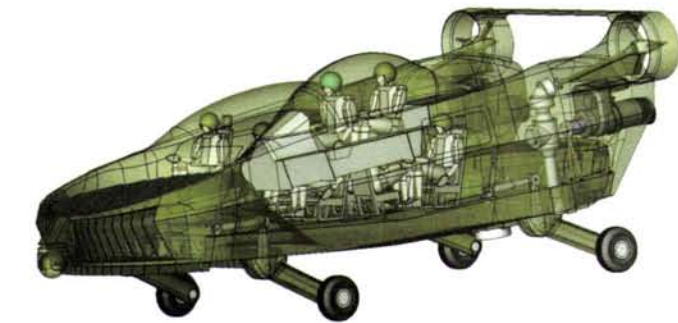


Mockup of Urban X-Hawk military version (Paul Jackson)

1159105

X-Hawk A. Design and construction of the latter's main lift rotors has been delegated to AeroComposites Inc; Purdy Corporation is designing the transmission system; and UrbanAero planned to award contracts for the variable-pitch thruster assemblies, thruster shrouds, fuselage, stabiliser and landing gear in the first quarter of 2006. By May 2006, company was engaged in completing main lift fan production tooling, passing critical design review (CDR) and starting production of transmission system, initiating thruster design and establishing a pilot simulation programme. A mockup of the 11-passenger military version was displayed at the Farnborough International Air Show in July 2006. Three versions,

with



Internal details of military Urban X-Hawk

1159101

different power plants, are planned. First flight anticipated mid-2008, first delivery in late 2009.

Bell Helicopter promoting X-Hawk **armed version** for US armed forces as combat troop carrier; in 2006 Bell and the Vertical Lift Research Center of Excellence at Penn State University were seeking Office of Naval Research funding for further development. Mockup shown at Farnborough in July 2006 carried two M61 multibarrel cannon on fuselage sides and nose-mounted sensor turret. Bell XworX to build demonstrator to X-Hawk C standard.

CUSTOMERS: First order (for X-Hawk A) received from Herzlia Medical Centre, Israel.

COSTS: Begins at approximately USD2.2 million to USD5.8 million, depending on version (2006).

DESIGN FEATURES: VTOL vehicle. Two standard aeroplane propellers (with optional de-icing) in vertical ducts and two pusher fans, all connected to pair of turboshaft engines mounted in rear nacelles. Rearward deflection of thrust from ducts provides forward motion; pusher fans contribute additional speed and are available for manoeuvring at the hover. Potential civil applications include medical access and evacuation, powerline maintenance, bridge inspection and ship-to-shore taxi operation. All essential systems fully redundant.

FLYING CONTROLS: Designed to be able to sustain hover and come to safe landing even if one engine fails. Patented vane control system (VCS) comprises two vertical ducts, each with set of 100 vanes top and bottom (400 vanes per aircraft). Independent deflection of vanes, between top and bottom and between two ducts, provides manoeuvrability, including ability to 'dock' alongside buildings.

LANDING GEAR: Four levered suspension legs, each with small, steerable road wheel. Wheels powered, to enable road taxiing at up to 10 kt (19 km/h; 12 mph).

POWER PLANT: Twin turboshafts, as follows:

X-Hawk A: 611 kW (820 shp) Honeywell LTS 101-B2, Pratt & Whitney Canada PW207 or Turbomeca Arrius 2K2.

X-Hawk B: 820 kW (1,100 shp) Arriel 2C2, PW210 or HTS 900.

X-Hawk C: 1,193 kW (1,600 shp) CTS 800-4N or MTR 390. Transmission rating 1,834 kW (2,460 shp).

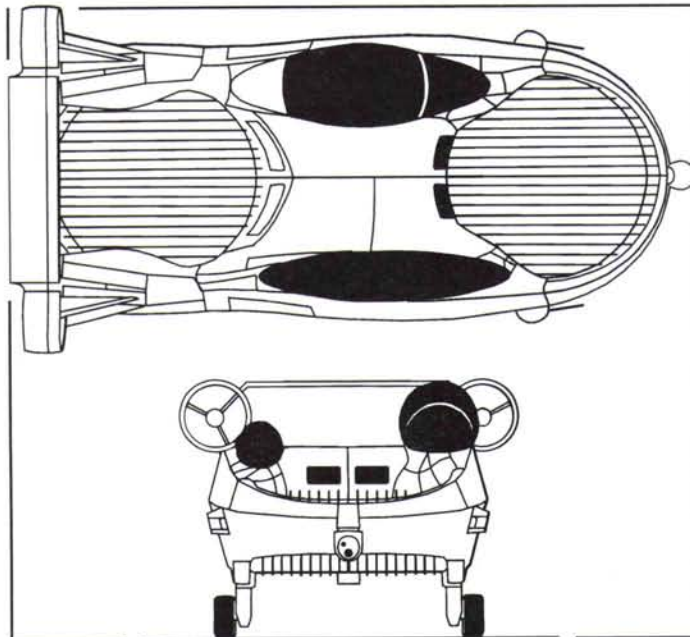
ACCOMMODATION: Four persons including pilot, in commercial version. Inboard-hinged, upward-opening canopy each side. Military version accommodates pilot and 11 troops: one passenger behind pilot under large port canopy; one beneath lower, starboard canopy; nine in cargo bay behind ducts, with door each side.

Following data are provisional:

EQUIPMENT: Rocket-deployed recovery parachute optional.

DIMENSIONS, EXTERNAL:

Rotor diameter (each) 2.50 m (8 ft 2½ in)
Length overall (excl sensor turret) 8.10 m (26 ft 7 in)
Height overall 3.50 m (11 ft 5¾ in)



Urban X-Hawk military version (Paul Jackson)

1159103

Fuselage max width 3.40 m (11 ft 1¾ in)

DIMENSIONS, INTERNAL:

Cabin volume (EMS configuration) 5.6 m³ (197.8 cu ft)

WEIGHTS AND LOADINGS:

Weight empty: A 1,157 kg (2,550 lb)

C 1,678 kg (3,700 lb)

Max fuel weight: A 431 kg (950 lb)

Typical mission fuel weight: C 590 kg (1,300 lb)

Typical payload: A 340 kg (750 lb)

B 454 kg (1,000 lb)

C 771 kg (1,700 lb)

Useful load: A 771 kg (1,700 lb)

B 907 kg (2,000 lb)

C 1,361 kg (3,000 lb)

Max T-O weight: A 1,927 kg (4,250 lb)

B 2,154 kg (4,750 lb)

C 3,039 kg (6,700 lb)

PERFORMANCE (estimated):

Max level speed: C 140 kt (259 km/h; 161 mph)

Max cruising speed: A 100 kt (185 km/h; 115 mph)

B 110 kt (204 km/h; 127 mph)

C 130 kt (241 km/h; 150 mph)

Hovering ceiling OGE, OEI: A 3,660 m (12,000 ft)

Range with typical mission fuel: C 330 n miles (611 km; 379 miles)

Operational radius with typical mission fuel, plus 30 min on site

140 n miles (259 km; 161 miles)

Endurance with typical payloads quoted above, 20 min reserves:

A, B 1 h 30 min

C 2 h

Italy

AEROLAB

AEROLAB SAS

Corso Sempione 41, I-21013 Gallarate (Va)

Fax: (+39 0331) 78 29 09

e-mail: info@aerolab.it

Web: www.aerolab.it

PRESIDENT: Francesco Rizzi

Company founded in 2001 by Sig Rizzi, an airliner and sport aircraft pilot, to produce a related family of light aircraft with a vintage aspect.

AEROLAB CAMP

TYPE: Two-seat kitbuilt.

PROGRAMME: Prototype I-CAMB, in low-wing configuration, first flew December 2005 and transported to US for announcement at Sun 'n' Fun, April 2006. Parasol version then due to fly in mid-2006, followed by biplane at unspecified date. US LSA approval due in 2007, but initially available as kit meeting 51 per cent rule.

CURRENT VERSIONS: **LoCamp**: Low-wing version.

HiCamp: Parasol wing version.

BiCamp: Biplane version. Data not yet defined.

COSTS: Monoplane kit USD41,340 including Rotec engine and exhaust collector (2006).

DESIGN FEATURES: Inspired by (high wing) Pietenpol Air Camper. Open cockpit; vintage appearance. Common fuselage with pick-up points for all three wing configurations. Monoplanes have unswept constant-chord, wings, cantilever low wing; parasol wing braced to lower longerons by V struts; biplane wings have different thickness and narrower chord, with slight sweepback. Tailplane braced to fin and lower longerons by streamlined wire. Sweepback fin.

Design and construction to European JAR-VLA criteria, but not certified as such, being available in Europe as Experimental category equivalent.

Quoted build time 500 hours; further 100 hours for BiCamp.

Wing section NACA 4416; dihedral 2°; no twist; plain fin and rudder.

FLYING CONTROLS: Conventional and manual. Frise ailerons; horn-balanced elevators and rudder. Pitch trim by electrically variable-incidence tailplane. Actuation by pushrods, except rudder by cables. Flaps.

STRUCTURE: AN (American) materials throughout. Welded chromoly steel tube fuselage with wooden stringers, plywood frames and engine cowling. Wooden wing of laser-cut components, including hemlock spar cap and birch ply shear-webs, plus aluminium flap and aileron structure. Dacron airframe covering. Wing spars joined at centreline by steel plates and LoCamp wing to fuselage by steel pins (total four) at each forward and aft spar. HiCamp wing mounted on cabane.

LANDING GEAR: Tailwheel type; fixed. Faired-in side Vs hinged to lower longerons; half-axes, each with helical spring shock-absorber, attached to compression frame on prototype; compressed rubber suspension for production version. Mainwheels 6.00-6 with hydraulic brakes; solid, steerable tailwheel.

POWER PLANT: One piston engine driving a two-blade wooden propeller (Aust Performance on prototype). Engine options comprise 82.0 kW (110 hp) Rotec R2800 seven-cylinder radial and four-cylinder 59.7 kW (80 hp) Parma-Technik Mikron IIIC. In 2006, 90.2 kW (121 hp) four-cylinder LOM M132A was under evaluation.

Fuel in two wingroot tanks; combined capacity 78 litres (20.6 US gallons; 17.2 Imp gallons).

ACCOMMODATION: Two in tandem in individual open cockpits, each with windscreen. Dual controls, but flown solo from rear seat. Luggage lockers forward and aft of cockpit group.

DIMENSIONS, EXTERNAL (Hi/LoCamp, where different):

Wing span 9.10 m (29 ft 10¼ in)

Wing aspect ratio 6.1

Length overall 6.71 m (22 ft 0 in)

Height overall: Lo:

propeller horizontal 1.95 m (6 ft 4¾ in)

propeller turning 2.51 m (8 ft 2¾ in)

Wheel track 1.68 m (5 ft 6¼ in)

Propeller diameter 1.83 m (6 ft 0 in)



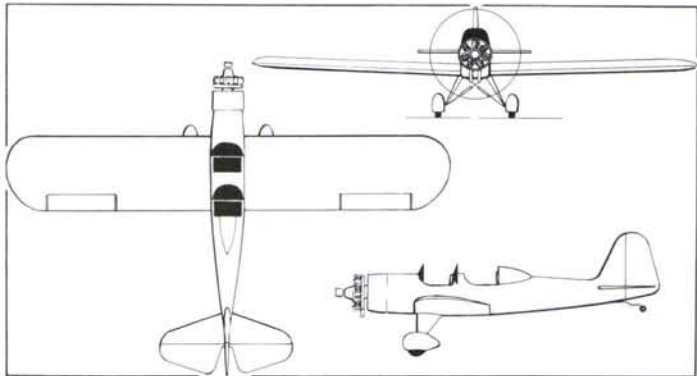
Prototype Aerolab LoCamp 1037978



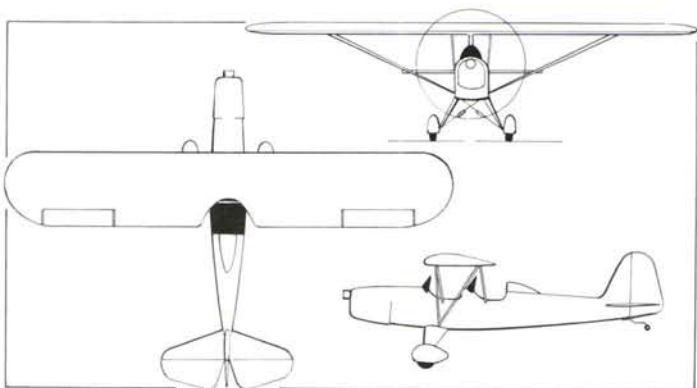
Impression of Aerolab BiCamp 1037997



Aerolab HiCamp parasol lightplane 1158002



Aerolab LoCamp tandem-seat lightplane (James Goulding) 1158444



High wing Aerolab HiCamp (James Goulding) 1158443

AREAS:

Wings, gross	13.50 m ² (145.3 sq ft)
--------------	------------------------------------

WEIGHTS AND LOADINGS (Rotec engine; Hi/LoCamp, where different):

Weight empty: Hi	350 kg (772 lb)
Lo	385 kg (849 lb)
Max baggage weight	44 kg (97 lb)
Max T-O weight: Hi	575 kg (1,267 lb)
Lo	598 kg (1,320 lb)
Max wing loading: Hi	42.6 kg/m ² (8.72 lb/sq ft)
Lo	44.4 kg/m ² (9.08 lb/sq ft)
Max power loading, Rotec engine: Hi	7.01 kg/kW (11.52 lb/hp)
Lo	7.30 kg/kW (12.00 lb/hp)

PERFORMANCE (Rotec engine, Hi/LoCamp):

Never-exceed speed (VNE)	114 kt (212 km/h; 132 mph)
Max level speed at S/L	105 kt (195 km/h; 121 mph)
Cruising speed at 75% power	92 kt (171 km/h; 106 mph)
Stalling speed: flaps up	40 kt (73 km/h; 45 mph)
flaps down	36 kt (66 km/h; 41 mph)
Max rate of climb at S/L	244 m (800 ft)/min
Service ceiling	3,660 m (12,000 ft)
T-O run	250 m (820 ft)
Landing run	200 m (655 ft)
Range with 30 min reserves	216 n miles (400 km; 248 miles)
g limits	+4/-2

AERMACCHI

AERMACCHI SPA
(A FINMECCANICA COMPANY)

Via Ing Paolo Foresi 1, PO Box 101, I-21040 Venegono Superiore (Varese)
Tel: (+39 0331) 81 31 11
Fax: (+39 0331) 82 81 96
e-mail: info@aermacchi.it
Web: www.aermacchi.it
CHAIRMAN: Giorgio Brazzelli
CEO: Carmelo Cosentino
GENERAL MANAGER: Massimo Lucchesini

Original Macchi Company, founded on 1 May 1913 in Varese, produced famous line of high-speed flying-boats and seaplanes. After the Second World War, specialised in aircraft for military pilot training, including MB-308, MB-326 and the MB-339 family, designed by Ermanno Bazzocchi.

On 1 January 1997, Aermacchi acquired all training activities and programmes of SIAI-Marchetti, including the SF.260 and S.211 (but not SF.600 Canguro, which was obtained by VulcanAir) and support of earlier S.205s and S.208s remaining in service. Production was then transferred from Sesto Calende to the Aermacchi plants at Venegono. In January 1996, Aermacchi obtained production rights to the former Valmet L-90TP Redigo turboprop trainer, which was renamed M-290TP Redigo.

Finmeccanica obtained control of the company by increasing its 27.4 per cent shareholding to 99 per cent on 19 December 2002, through acquisition of Foresio's family shareholding, this becoming effective on 1 July 2003.

Control passed in January 2005 from Finmeccanica to Alenia Aeronautica, the leading industry of Finmeccanica's aeronautical sector.

Aermacchi is an aircraft manufacturing company, with plants in Venegono airfield occupying a total area of 274,000 m² (2,949,400 sq ft), including 113,000 m² (1,216,350 sq ft) covered space; flight test centre covers a space of 5,100 m² (54,900 sq ft) in a total area of 28,000 m² (301,400 sq ft).

Workforce in 2005 totalled over 1,840. Value of production was EUR298 million in 2005. The experience gained in the military sector has allowed the company to extend its business also to the civil aviation field, which currently accounts for around 3 per cent of the order portfolio.

Product range includes SF-260E/TP piston-engined or turboprop-powered screener/primary trainer; M-311 basic turbofan; MB-339CD advanced and lead-in fighter trainer; currently out of production; and M-346, an advanced and lead-in fighter trainer. Allied with Dassault, EADS and Saab, Aermacchi was the leading company for the EuroTraining Feasibility Study (contract signed 2 December 2002), for a 12-nation European Military Integrated Training System.

Since 1960, 40 countries have bought 2,000 Aermacchi trainers. Co-operation in international military programme has included AMX with Alenia Aeronautica and Embraer of Brazil, with work share of 24 per cent. Aermacchi developed and manufactured the fuselage forward and rear sections and installed some avionics equipment. A Mid-Life Updating program (ACOL) has been launched by the Italian Air Force. For Panavia Tornado, Aermacchi designed and produced wing pylons and wingtips, roots, trailing-edges and flaps, representing a 5 per cent share in the programme.

In Eurofighter, Aermacchi has a share exceeding 4 per cent, for design and development of wing pylons, twin missile and twin store carriers, ECM pods, carbon fibre structures and titanium engine cowlings.

After participating in the G.222 transport aircraft program, the company is currently involved with the C-27J Spartan, producing outer wings.

Aermacchi has added design and production of nacelle components for civil aircraft. In 1999, it established the joint venture MHD with the French company Hurel Dubois, to provide complete nacelle system services (including engine build up and thrust reversal), ranging from business jets to 100-seat airliners for the regional market. Aermacchi is collaborating with several customers and partners in international programmes such as: Pratt & Whitney for the inlets and fan cowl for the A330 with PW4168 engines; Aircelle for the inlet of Airbus A318s powered by PW6000 engines and for the translating cowl and fixed fan duct of the Airbus A380 (for both engine options: Engine Alliance GP7200 and Rolls Royce T900); with General Electric, through the MHD joint venture, for the complete nacelles, including EBU, for the Embraer 170; with Pratt & Whitney Canada, through the MHD joint venture, for the lateral and centre nacelles for the Dassault Falcon 7X; and with Goodrich Aerostructure for the fan cowl for both engine applications of the Boeing 787, in addition to the contract for the Airbus A350 and the collaboration for inlet and fan cowl for the CFM56-5A/B nacelles for the Airbus narrow-body line.

AERMACCHI SF-260

Uruguayan Air Force designation: T-260

TYPE: Basic prop trainer/attack lightplane.

PROGRAMME: Originated as F.250 designed by Stelio Frati and made by Aviamilano; SF.250 prototype (I-RAIE) flew 15 July 1964, combining wings of F.8L Falco and fuselage of F.15 Picchio with modified canopy. One only, followed by two SF.260 prototypes (I-ALLA and HB-ELB) before project passed to SIAI-Marchetti.

Initial civil variants were SF.260 and SF.260B (Waco TS-250-3 Meteor on US market), followed by increased wing span SF.260C; SF.260D was later civil variant; SF.260M military trainer, sold widely in several subvariants; current versions developed (unsuccessfully) for USAF's Enhanced Flight Screener requirement; still in low-volume production as a military trainer following transfer of design rights to Aermacchi in 1997 as SF-260 (with hyphen). By 2004, SF-260s had flown more than 1,800,000 hours.

CURRENT VERSIONS: **SF-260E:** Direct-injection engine, strengthened airframe and 100 kg (220 lb) higher aerobatic weight than superseded SF.260D. Wing aerodynamically refined to preserve original stalling speed, despite increased MTOW; fence at approximately two-thirds of span; automatic fuel management. Canopy height and width increased. Certified by RAI on 21 January 1992 and by FAA on 17 August 1994.

Main description applies to SF-260E and Warrior.

SF-260EA: In November 2003, 30 SF-260EAs were ordered by the Italian Air Force to replace SF-260AMs of 70^o Stormo at Latina in the primary training role; deliveries contracted from early 2005, agreement also including buy-back of 21 SF-260AMs. First IAF aircraft (MM55098) flew 20 (initially announced as 21st) October 2004; certified by Italian National Armaments Directorate on 10 May 2005; initial two deliveries to 70^o Stormo at Latina on 4 August 2005; last delivery due mid-2006. Compared with SF-260AM, has new navigation and communications equipment (VOR/ILS, ADF, DME, GPS, ADI and HSI; dual VHF/AM and UHF/AM); revised canopy shape, new ventilation and air conditioning system and improved servicing access.

SF-260F: As SF-260E, but carburetted engine. Promotion discontinued.

SF-260E Warrior: Two underwing pylons, for up to total 300 kg (661 lb) of external stores, and cockpit stores selection panel. Able to undertake a wide variety of roles, including low-level strike; forward air control; forward air support; armed reconnaissance; and liaison. Export versions are SF-260EU.

SF-260TP: Turboprop-powered version. No recent production known.

CUSTOMERS: Total of some 880 produced (including turboprop version) for customers in 27 countries. Civil operators include Sabena, Royal Air Maroc and Alitalia. Six SF-260Fs ordered by Air Force of Zimbabwe, early 1997, of which last delivered in October 1998; these were first of type built at Venegono. In June 1998, 12 SF-260Es bought by Venezuelan Air Force, and delivered to 14 Grupo at Maracay from late 2000. Delivery of 13 SF-260Es to Uruguayan Air Force began in September 1999, following first flight on 23 July, and completed in December 2000. Mexico placed order in early 1998, initially for 13, but subsequently 30, of which first six delivered in early 2000. Four Warrior variants of SF-260EU to Mauritania in 2000.

AERMACCHI SF-260 MILITARY CUSTOMERS

Operator	Variant	Qty	First Aircraft
Belgium	MB	36	ST-01
	D	9	ST-40
Bolivia	CB	6	FAB-180
Burkina Faso	W	2	129
Burundi	C	4 ²	
Congo		3	9U-RUA
Republic	MC	21	AT-101
Dubai	TP	6	401
	W	1	H
Ethiopia	TP	11	156?
Haiti	TP	6	1271
Ireland	WE	11	222
Italy	260	3	MM91004
	AM	45	MM54418
	EA	30	MM55098
Libya	W	240	
Mauritania	EU	4 ¹ and 5	ST-MAK
Mexico	E	30 ¹	6101
Myanmar	M	20	2001
Philippines	MP	30	601
	WP	16	631
	TP	18	701
	W	12	151
Singapore	MS	16	120
Somalia	C	6	60-SBC
	W	10	
Sri Lanka	TP	9 ³	CT121
Thailand	MT	19	15-01
Tunisia	CT	6	W41501
	WT	12	W41401
	D	41	773
Turkey		3 ⁴	AF504
Uganda		13 ¹	610
Uruguay	EU	12 ¹	0027
Venezuela	EU	9	AF-507
Zambia	MZ	17	R9900
Zimbabwe	C	14	R3260
	W	6 ¹	
	F		
Subtotal		757	
various civil		125	
Total		882	

¹ Built by Aermacchi

² Plus others second-hand

³ Plus three second-hand

⁴ Plus two or three from Libya

⁵ Warrior

Notes: Nicaragua received some from Libya; Singapore donated 19 to Indonesia in 2002.

DESIGN FEATURES: Side-by-side, piston-engined aerobatic trainer. Low-mounted wings with forward-swept trailing-edges and tip tanks; sweptback fin.

Wing section NACA 64₁-212 (modified) at root, 64₁-210 (modified) at tip; dihedral 6.5° 20' from roots.

FLYING CONTROLS: Conventional and manual. Frise ailerons each with servo tab; trim tabs for all three axes; four-way trim button on each stick top; electrically operated slotted flaps; controls operated by dual cables.

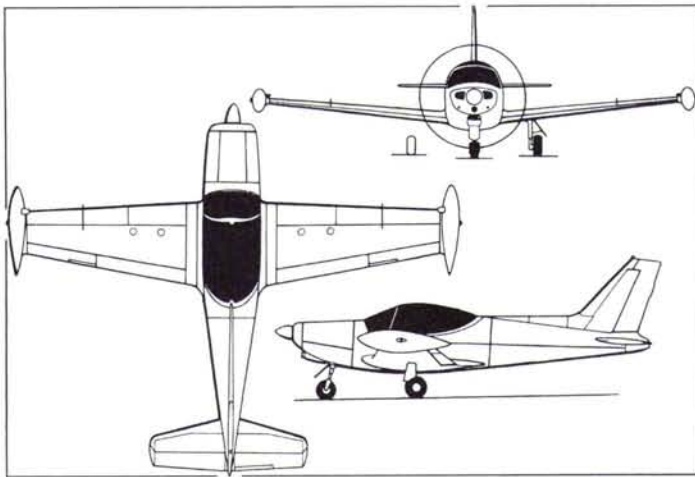
STRUCTURE: All-metal stressed skin structure; wing skin formed of butt-jointed panels flush riveted; single main spar and auxiliary rear spar; press-formed ribs; wings bolted together on centreline and attached to fuselage by six bolts. Fatigue life 15,000 hours.

LANDING GEAR: Electrically retractable tricycle type, with manual emergency actuation. Inward-retracting main gear, of trailing arm type, and rearward-retracting nose unit, each embodying Magnaghi oleo-pneumatic shock-absorber (Type 2/22028 in main units). Nose



Aermacchi SF-260E basic piston-engined trainer

1159315



Aermacchi SF-260E/F basic prop trainer (Paul Jackson)

1159397

AERMACCHI M-311

TYPE: Basic jet trainer/light attack jet.

PROGRAMME: Announced at Farnborough International, July 2004, as substantially upgraded version of S.211, incorporating features of S.211A upgrade.

S.211 designed by SIAI-Marchetti and revealed in June 1977; first flight (I-SITF) 10 April 1981. Sold to Haiti (four; not used and to US civilian owners), Philippines (24, including 14 assembled locally) and Singapore (30, comprising six kits and 24 locally-built). Last delivery in 1991; promotion continued, including unsuccessful evaluation for USAF/USN JPATS programme. Acquired by Aermacchi in January 1997, which proposed modifications for existing machines, as detailed in *Jane's Aircraft Upgrades*.

M-311 avionics demonstrator (prototype) converted from S.211 JPATS demonstrator I-PATS. First flight 1 June 2005; exhibited at Paris Air Show later that month. Agreement signed with Turkish Aerospace Industries and announced on 16 June 2005 created joint engineering team and identified development and potential work-share areas for Turkey in M-311 programme.

Representative prototype, also converted from S.211 airframe, due to fly late 2006, incorporating most of proposed hardware changes for M-311, including JT15D-5C turbofan. First flight of production aircraft possible in late 2007, given early order.

CUSTOMERS: None. Offered to Singapore, Turkey and UK.

COSTS: Near-term market for 120 aircraft valued at USD900 million.

DESIGN FEATURES: Compared with S.211, has strengthened airframe for increased manoeuvre envelope and longer fatigue life, plus new systems and maintenance philosophy. HOTAS controls; HUD, MFDs and embedded simulation capability.

Shoulder-wing NASA GAW-I aerofoil; drooped wingtips; sweepback 15° 30' at quarter-chord; thickness/chord ratio 15 per cent at root, 13 per cent at tip; anhedral 2° from root; twist -3° 17'.

FLYING CONTROLS: Variable incidence tailplane; servo tab and horn balanced elevator; boosted ailerons powered by single hydraulic actuator in fuselage with electrically actuated trim bias in aileron linkage; trimmable rudder; electrically actuated Fowler flaps; hydraulically actuated airbrake under centre-fuselage.

STRUCTURE: Two-spar, one-piece metal wing forming integral tank in torsion box and bolted to fuselage; upper and lower skins formed in single sheets; 60 per cent of external surfaces of fuselage in composites. Intake trunking made of GFRP moulding reinforced with helically wound CFRP tapes and metal-sprayed on inner surface.

LANDING GEAR: Hydraulically retractable tricycle type, of Messier/Magnaghi design. Oleo-pneumatic shock-absorber in each unit. All units retract forward into fuselage (main units turning through 90° to lie flat in undersides of engine air intake trunks). Nosewheel steerable ±18°; powered steering system may be offered. Mainwheels size 6.50-8; nosewheel size 5.00-5 with water-deflecting chined tyre. Designed for sink rate of 4 m (13 ft)/s. Wheel brakes actuated hydraulically, independently of main hydraulic system. Provision for emergency free-fall extension.

POWER PLANT: One 14.19 kN (3,190 lb st) Pratt & Whitney Canada JT15D-5C turbofan with automatic ignition, chip detectors and compressor bleed valve to eliminate surge; noise and emissions meet FAR Pt 36 and ICAO rules. Lateral intake each side of fuselage, with splitter plate. Fuel in integral wing tanks and fuselage bladder tank; total capacity approx 910 litres (240 US gallons; 200 Imp gallons). Single-point pressure refuelling in top surface of starboard wing. Electric fuel pump for engine starting and emergency use. Fuel and oil systems permit inverted flight. Provision for two 270 litre (71.3 US gallon; 59.4 Imp gallon) drop tanks on inboard underwing stores points. Oil capacity 10 kg (22 lb).

ACCOMMODATION: Two pilots in tandem, stepped up 28 cm (11 in) in rear, on Martin-Baker Mk 10 lightweight zero/zero ejection seats. Blast screen between seats. Pressurised and air conditioned cockpit under one-piece framed canopy opening sideways to starboard.

SYSTEMS: ECS for cockpit pressurisation and air conditioning, using engine bleed air for heating. Maximum pressure differential 0.24 bar (3.5 lb/sq in). Hydraulic system pressure 207 bars (3,000 lb/sq in), for actuation of airbrake, landing gear, Freon compressor and aileron boost, and independent actuation of wheel brakes. Primary electrical system is 28 V DC, using engine-driven starter/generator; Ni/Cd battery; two static inverters supply AC power for instruments and avionics. External power receptacle in port side of lower fuselage aft of wing. OBOGS.

AVIONICS: *Comms:* Dual V/UHF transceivers, intercom, and IFF or ATC transponder, standard.

Flight: Optional moving map display.

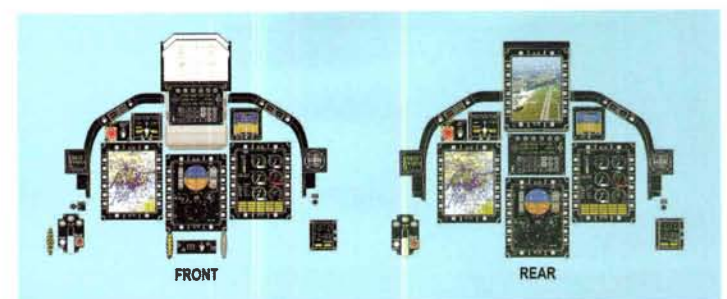
Instrumentation: HUD in front cockpit, plus repeater in rear; three-screen EFIS (127 × 178 mm; 5 × 7 in) in each cockpit. NVG compatible.

Mission: Onboard simulation of sensors including multimode fire control radar (air-air and air-ground) and electronic warfare suite (RWR, MWS, chaff/flare dispenser), weapons and tactical scenario operating air/ground datalink (computer-generated forces, hostile integrated air defence system, including airborne surface, naval and missile threats).

ARMAMENT: Optional stores management system. Four underwing hardpoints, stressed for loads of up to 350 kg (772 lb) inboard and 250 kg (551 lb) outboard, plus centreline pylon stressed for 90 kg (198 lb); maximum external load 1,090 kg (2,403 lb); (inboard only) two bombs or napalm containers of up to 300 kg; or four 74 mm cartridge dispensers; or parachuting containers; S.211A can have special container or 12.7 mm gun pod on fuselage centreline pylon.

DIMENSIONS, EXTERNAL:

Wing span	8.47 m (27 ft 9½ in)
Wing chord: at root	2.15 m (7 ft 0¾ in)
mean aerodynamic	1.65 m (5 ft 5 in)
at tip	1.00 m (3 ft 3¼ in)
Wing aspect ratio	5.7
Length overall	9.85 m (32 ft 3¾ in)
Height overall	3.74 m (12 ft 3¼ in)
Tailplane span	4.16 m (13 ft 7¾ in)
Wheel track	2.40 m (7 ft 10½ in)
Wheelbase	4.04 m (13 ft 3 in)



Front and rear cockpits of Aermacchi M-311

1154288

unit is of leg and fork type, with coaxial shock-absorber and torque strut. Cleveland P/N 3080A mainwheels, with size 6.00-8 tube and tyre (6 ply rating), pressure 2.45 bar (36 lb/sq in). Cleveland P/N 40-77A nosewheel, with size 5.00-5 tube and tyre (8 ply rating), pressure 1.96 bar (28 lb/sq in). Cleveland P/N 3000-500 independent hydraulic single-disc brake on each mainwheel; parking brake. Nosewheel steering (±20°) operated directly by rudder pedals.

POWER PLANT: One 194 kW (260 hp) Textron Lycoming AEIO-540-D4A5 flat-six driving a Hartzell HC-C2YK-1BF/8477-8R two-blade, constant-speed, metal propeller.

Fuel in two light alloy tanks in wings each holding 49.5 litres (13.1 US gallons; 10.9 Imp gallons); and two permanent wingtip tanks each holding 72 litres (19.0 US gallons; 15.85 Imp gallons). Total internal fuel capacity 243 litres (64.2 US gallons; 53.3 Imp gallons), of which 235 litres (62.1 US gallons; 51.7 Imp gallons) are usable. Individual refuelling point on top of each tank. In addition, SF-260W may be fitted with two 80 litre (21.1 US gallon; 17.5 Imp gallon) auxiliary tanks on underwing pylons. Oil capacity (all models) 11.4 litres (3.0 US gallons; 2.5 Imp gallons).

ACCOMMODATION: Two pilots side by side in adjustable seats, with full blind-flying panel on right and reduced panel and radio on left. Third seat in rear. All three seats equipped with lap belts and shoulder harnesses. Baggage compartment aft of rear seat. Upper portion of sliding canopy tinted. Emergency canopy release handle for front seat occupant. Steel tube windscreen frame for protection in the event of an overturn. Air conditioning, oxygen and enlarged canopy optional.

SYSTEMS: Foot-powered hydraulics for mainwheel brakes only. No pneumatic system. 24 V DC electrical system of single-conductor negative earth type, including 70 A Prestolite engine-mounted alternator/rectifier and 24 V 24 Ah battery, for engine starting, flap and landing gear actuation, fuel booster pumps, electronics and lighting. Sealed battery compartment in rear of fuselage on port side. Connection of an external power source automatically disconnects the battery. Heating system for carburettor air intake. Cabin heating, and windscreen de-icing and demisting, by heat exchanger using engine exhaust muffler. Additional manually controlled warm air outlets for general cabin heating. Optional R134a gas air conditioning system and autopilot both available from 2000.

AVIONICS: *Comms:* Bendix/King or Rockwell Collins airways radio with dual com and nav; in SF-260E, avionics mounted aft of cabin and battery moved forward.

EQUIPMENT: Military equipment to customer's requirements. External stores can include one or two reconnaissance pods with two 70 mm automatic cameras, or two emergency supply containers or two external tanks. Landing light in nose, below spinner.

ARMAMENT: Warrior has two underwing hardpoints, able to carry external stores on NATO 356 mm (14 in) racks up to a maximum of 300 kg (661 lb) when flown as a single-seater. Typical alternative loads can include gun pods, each with 7.62 mm FN machine guns and 500 rounds; or 0.50 Browning machine gun; two Thiokol LUU-2/B parachute flares; bombs up to 150 kg (331 lb); Mk 76 practice bombs; two cartridge throwers for 70 mm multipurpose cartridges, F 725 flares or F 130 smoke cartridges.

DIMENSIONS, EXTERNAL:

Wing span over tip tanks	8.35 m (27 ft 4¾ in)
Wing chord: at root	1.60 m (5 ft 3 in)
mean aerodynamic	1.325 m (4 ft 4¼ in)
at tip	0.785 m (2 ft 7 in)
Wing aspect ratio (excl tip tanks)	6.3
Wing taper ratio	2.2
Length overall	7.10 m (23 ft 3½ in)
Fuselage: Max width	1.10 m (3 ft 7¼ in)
Max depth	1.04 m (3 ft 5 in)
Height overall	2.41 m (7 ft 11 in)
Elevator span	3.01 m (9 ft 10½ in)
Wheel track	2.275 m (7 ft 5½ in)
Wheelbase	1.66 m (5 ft 5¼ in)
Propeller diameter	1.93 m (6 ft 4 in)
Propeller ground clearance	0.32 m (1 ft 0½ in)

DIMENSIONS, INTERNAL:

Cabin: Length	1.66 m (5 ft 5¼ in)
Max width	1.00 m (3 ft 3¼ in)
Height: from seat cushion:	
to canopy	0.98 m (3 ft 2½ in)
to enlarged canopy	1.07 m (3 ft 6 in)
Volume	1.5 m³ (53 cu ft)
Baggage compartment volume	0.18 m³ (6.4 cu ft)

AREAS:

Wings, gross	10.10 m² (108.7 sq ft)
Ailerons (total, incl tabs)	0.76 m² (8.18 sq ft)
Trailing-edge flaps (total)	1.18 m² (12.70 sq ft)
Fin	0.76 m² (8.18 sq ft)
Dorsal fin	0.16 m² (1.72 sq ft)
Rudder, incl tab	0.60 m² (6.46 sq ft)
Tailplane	1.46 m² (15.70 sq ft)
Elevator, incl tab	0.96 m² (10.30 sq ft)

WEIGHTS AND LOADINGS:

Manufacturer's basic weight empty	779 kg (1,717 lb)
Weight empty, equipped	840 kg (1,852 lb)
Baggage capacity	20 kg (44 lb)
Max fuel weight: wing internal and tip tanks (all versions)	169 kg (372.5 lb)
underwing tanks	115 kg (254 lb)
Max T-O weight: E: Aerobatic	1,200 kg (2,645 lb)
Utility	1,300 kg (2,866 lb)
Warrior	1,350 kg (2,976 lb)
Max wing loading: E: Aerobatic	118.8 kg/m² (24.33 lb/sq ft)
Utility	128.7 kg/m² (26.36 lb/sq ft)
Warrior	128.7 kg/m² (26.36 lb/sq ft)
Max power loading: E: Aerobatic	6.18 kg/kW (10.17 lb/hp)
Utility	6.70 kg/kW (11.02 lb/hp)
Warrior	6.97 kg/kW (11.45 lb/hp)

PERFORMANCE (at 1,100 kg; 2,425 lb):

Never-exceed speed (VNE)	236 kt (437 km/h; 271 mph)
Max level speed at S/L	182 kt (337 km/h; 209 mph)
Cruising speed at 75% power at 1,830 m (6,000 ft)	175 kt (324 km/h; 201 mph)
Stalling speed, flaps down	59 kt (110 km/h; 68 mph)
Max rate of climb at S/L	548 m (1,800 ft)/min
Service ceiling	5,790 m (19,000 ft)
T-O run	275 m (905 ft)
Landing run	270 m (885 ft)
Range with max internal fuel	710 n miles (1,314 km; 817 miles)
Max range, internal and external fuel	1,090 n miles (2,018 km; 1,254 miles)
g limits	+6/-3



Aermacchi M-311 'avionics demonstrator' being exhibited at Singapore in February 2006 (Paul Jackson)

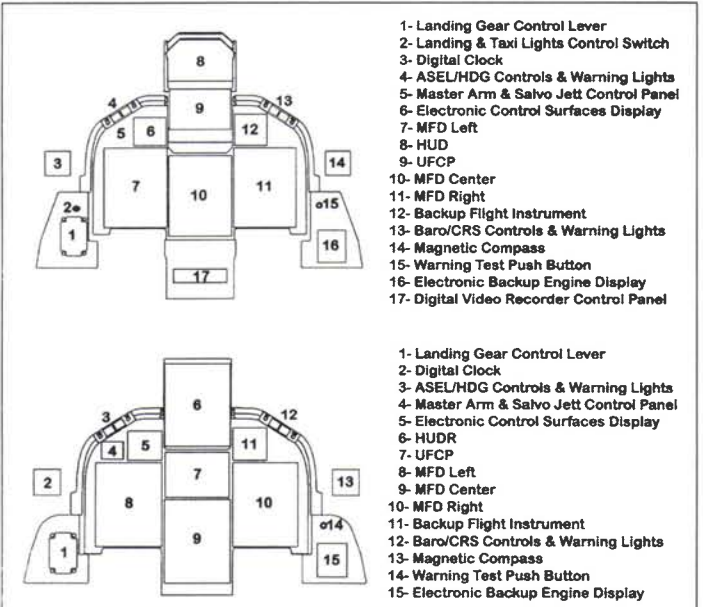
1154287

AREAS:

Wings, gross	12.60 m ² (135.6 sq ft)
Airbrake	0.42 m ² (4.52 sq ft)
Vertical tail surfaces (total)	2.01 m ² (21.64 sq ft)
Horizontal tail surfaces (total)	3.38 m ² (36.38 sq ft)

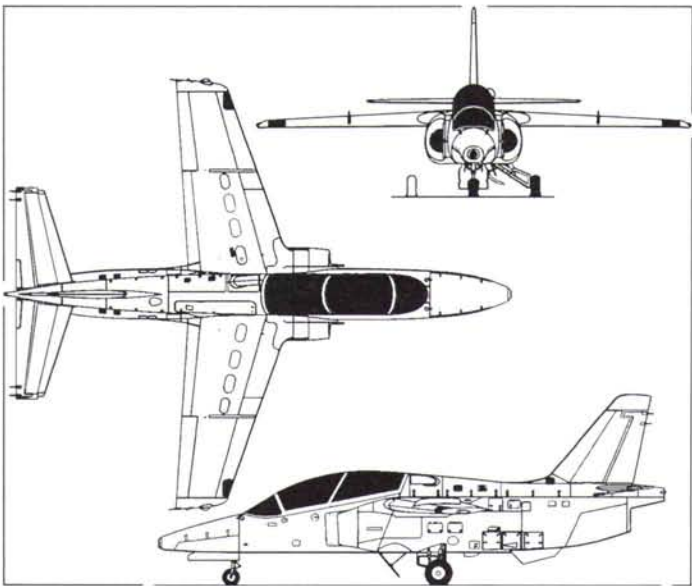
WEIGHTS AND LOADINGS:

Weight empty	2,300 kg (5,070 lb)
Max weapon load	1,000 kg (2,205 lb)
Max fuel weight: internal	696 kg (1,534 lb)
external	424 kg (935 lb)



Key to Aermacchi M-311 cockpits layout

1154286



Aermacchi M-311 basic jet trainer

1158269

Max T-O weight: trainer, clean	3,200 kg (7,054 lb)
armed version	4,100 kg (9,039 lb)
Max wing loading:	
trainer, clean	254.0 kg/m ² (52.02 lb/sq ft)
armed version	325.4 kg/m ² (66.65 lb/sq ft)
Max power loading:	
trainer, clean	225 kg/kN (2.21 lb/lb st)
armed version	289 kg/kN (2.83 lb/lb st)

PERFORMANCE (estimated):

Never-exceed speed (VNE)	M0.80 (430 kt; 796 km/h; 485 mph EAS)
Max level speed, clean: at S/L	380 kt (704 km/h; 437 mph)
at FL200	400 kt (740 km/h; 460 mph)
Stalling speed, flaps down	84 kt (156 km/h; 97 mph)
Max rate of climb at S/L	1,438 m (4,718 ft)/min
Service ceiling	12,200 m (40,000 ft)
T-O run	450 m (1,480 ft)
Landing run	460 m (1,510 ft)
Max range on internal fuel, reserves 10%	740 n miles (1,370 km; 851 miles)
Ferry range with max internal and external fuel, 10% reserves	960 n miles (1,777 km; 1,104 miles)
g limits: clean	+7/-3.5
with external stores	+5/-2.5

AERMACCHI MB-339

TYPE: Basic jet trainer/light attack jet.

PROGRAMME:

DEVELOPMENT MILESTONES

Programme launched	11 Feb 75
First flight	12 Aug 76
First flight, production	20 Jul 78
First delivery (IAF)	8 Aug 79

MB-339A selected by Italian Air Force on 11 February 1975 in preference to MB-338; one static test airframe and two prototypes: first flights (MM588) 12 August 1976 and (MM589) 20 May 1977; first flight of production MB-339A (MM54438) 20 July 1978; initial two deliveries (MM54439 and 54440) on 8 August 1979; first batch of 51 included three used as radio calibration aircraft at Pratica di Mare and 14 PANs for Freccia Tricolori aerobatic team.

MB-339C developed as an uprated MB-339 with a Viper 680 power plant; experimental installation in I-MABX, first flown on 9 June 1983; initial MB-339C first flight (I-AMDA) 17 December 1985; production aircraft (I-TRON) 8 November 1989. The 200th MB-339 (a 339CE for Eritrea) was delivered on 14 April 1997. MB-339s had flown some 500,000 hours by late 2002. Final delivery from main production run was made (to Italian Air Force) in 2004, but Malaysian Air Force ordered batch of eight in November 2006, deliveries to begin 24 months later.

CURRENT VERSIONS: **MB-339A:** Initial military basic/advanced trainer. Final deliveries (small attrition replacement batch for Italy) in 1995. Main operator is 61° Stormo Scuola Volo Basico Iniziale su Aviogetti at Lecce-Galatina.

LIT110 billion MLU initiated in mid-1999 includes structural modifications on intended 70 aircraft to extend service lives from 10,000 to 15,000 hours (from 20 to 30 years). By A2004, updating reportedly to affect only 49 MB-339As, several others by then having been placed in storage or retired. Features of MLU include Litton Italia LISA-FG GPS/INS; new integrated air data transducer; provision for AN/ARC-150(V) Have Quick secure radio; Elmer crash recorder; ELT; instrument panel modifications; radio switches on control column; formation flying lights; higher-capacity batteries connected in parallel with starter/generator; provision for target towing; anti-skid brakes; nosewheel splash-guard; repositioned IFF antenna; airborne stress gauge; and improved access, by means of additional removable panels, to wing/fuselage joint for inspection and engine maintenance. Depot maintenance interval will increase to 1,500 hours after MLU. Prototype (CSX54453) first flown 20 December 1999; 'production' will take between eight and 10 years for whole fleet; first pair (MM54497 and MM54505) redelivered in 2002. As part of trials for expanded role of Italian MB-339s, AIM-9L Sidewinder AAM launch trials began mid-2003.

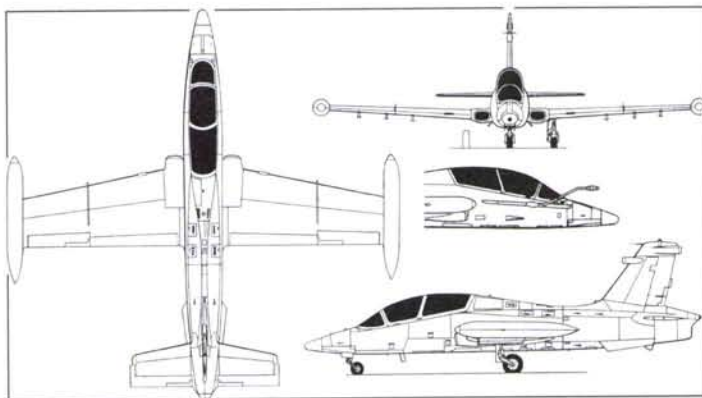
MB-339PAN: (Pattuglia Acrobatica Nazionale: national aerobatic team) Special version of MB-339A for Italian Air Force; smoke generator added; wingtip tanks deleted. Official debut 27 April 1982. Total 29 built as, or converted to, PAN. Included in MLU.

MB-339AM: Special anti-ship version armed with AOSM Marte Mk 2A missile; avionics, equivalent to MB-339C, include new inertial navigator, Doppler radar, navigation and attack computers, head-up display and multifunction display. Prototype converted from MB-339A; qualification completed January 1995. No known orders.



Aermacchi MB-339AMs from first Malaysian contract

1040563



Aermacchi MB-339CD advanced trainer and attack aircraft, with additional starboard side view of optional refuelling probe (Dennis Punnett)

0507612

MB-339B: Powered by 19.57 kN (4,400 lb st) Viper Mk 680-43; larger tip tanks. Prototype (demonstrator I-GROW) modified in 1993 with two LCD EFIS displays and air-to-air refuelling (AAR).

MB-339RM: (*Radiomisure*: radio calibration) Three produced for Italian Air Force, 1981; withdrawn and transferred to training as MB-339As. However, one MB-339RM reassigned to 71° Gruppo di 14° Stormo in February 2003 for calibration duties.

T-Bird II: One demonstrator modified for US JPATS competition; delivered to Lockheed factory at Marietta, Georgia, on 20 May 1992. Power plant, one Rolls-Royce Viper 680-582 of 17.79 kN (4,000 lb st) with noise reduction kit. Rejected in favour of Pilatus PC-9 (Raytheon T-6A Texan II), June 1995. Continues in use as chase aircraft.

MB-339CB: For Royal New Zealand Air Force; Viper 680 engine. Served with 14 Squadron at Ohakea in training and light attack roles until 13 December 2001, when unit disbanded and aircraft offered for sale being subsequently bought by Malaysia.

MB-339CD: (C Digital) Developed for Italian Air Force advanced/fighter lead-in training against order for 15. Rolled out 12 April 1996; first flight (conversion of MB-339A MM54544; renumbered MMX606) 24 April 1996. Rolls-Royce Viper Mk 632-43 engine; removable in-flight refuelling probe (first phase of tanker trials completed March 1996 by development MB-339 I-GROW); new avionics architecture based on a single central mission computer, MIL-STD-1553B digital databus, one ring laser gyro platform with embedded GPS. EFIS cockpits with HUD in each, three identical liquid crystal colour MFDs and HOTAS controls. Other details generally as MB-339CB, but (compared with MB-339A) nose lengthened; elevators modified to give handling characteristics closer to the fast jets to which students will progress; some structural parts and systems modified; and pilots' escape system updated. Achieved full operational capability with IAF in October 1998 after 148 sorties by prototype.

Contract signed in August 2001 for further 15 MB-339CDs, designated **MB-339CD2**; prototype was conversion of MMX606, first flown in new guise on 6 November 2001; new features of Lot 2 include 8.33 kHz radios, onboard simulation of electronic warfare (RWR, MAWS, chaff/flare), IFF Mode S, crash data recorder, ELT and underwater acoustic beacon, multifunctional information distribution system, full NVG capability, digital map system and autonomous air combat manoeuvring instrumentation. All new features being retrofitted to first batch, and contract includes full-mission simulator installed at Lecce-Galatina air base in December 2002. Initial aircraft of Lot 2 (MM55077) first flew 24 May 2002 and delivered September 2002. Clearance issued in July 2002 for carriage of autonomous air combat manoeuvring instrumentation (AACMI) pod on port outer wing pylon. Sidewinder AAM carriage qualified 2003.

In June 2003 the MB-339CD prototype made the first flight of an onboard embedded simulation system funded by five European air forces. Begun in February 2000 and designated RTP11.12, this allows pilots to train against simulated adversaries, in a virtual scenario including a threat environment, while flying a real aircraft — otherwise WaSiF: weapon simulation in flight. Project completed July 2003 on achievement of five test- and nine demonstration sorties.

Detailed description applies to the above version.

MB-339CM: Second-generation Malaysian version, generally as MB-339CD, but Malaysian industry providing ejection seats and some avionics. Deliveries from 2008.

MB-339CE: Variant of MB-339CD; Viper 680 engine. Six ordered by Eritrea on 7 November 1995; deliveries began April 1997.

MB-339FD: (Full Digital) Export equivalent of CD, with Viper 680 engine. Offered to Australia in 1994; unsuccessful in competition against the BAE Systems' Hawk. Also offered to Brazil and South Africa as Xavante/Impala replacement. Purchase by Venezuela of an initial eight announced 7 July 1998, but decision subsequently reversed and competition reopened; no further announcement by early 2003.

CUSTOMERS: Refer to table. Initial fifteen CDs ordered by Italian Air Force; delivery of two aircraft on 18 December 1996, followed by further 10 in 1997 and three in 1998 (last in November); first four to Reparto Sperimentale Volo at Pratica di Mare for trials before issue to 61° Stormo; some assigned to base flights at Gioia del Colle and Novara-Cameri for

continuation training, including in-flight refuelling. Further 15 supplied in 2002–2003, comprising seven by December 2002 (initially on CB1 software configuration) and balance by December 2003.

COSTS: Malaysian contract for eight, plus spares and two years' support, valued at EUR88 million (2006).

DESIGN FEATURES: Conventional subsonic jet trainer with tandem, stepped cockpits and low, moderately sweptback wing. Designed to MIL-A-8866A for 15,000 hours service life. Intended maintenance requirement of 3.5 mmh/th; scheduled maintenance at 150 and 300 hour intervals; inspection at 1,800 hours.

Wing section NACA 64A-114 (mod) at centreline, 64A-212 (mod) at tip; quarter-chord sweepback 8° 29'.

FLYING CONTROLS: Conventional. Power-assisted ailerons with artificial feel, plus servo tabs to assist emergency manual reversion; elevators and rudder actuated manually by pushrods; electrically controlled servo tab for control assistance and trimming on elevator; hydraulically actuated single-slotted flaps; two ventral strakes under tail; electrohydraulically actuated airbrake panel under forward fuselage; wing fence ahead of aileron inboard edge; both pilots have HUD; rear pilot elevated sufficiently to be able to aim guns and air-to-surface weapons and fly visual approaches (see nav/attack system under Avionics heading).

STRUCTURE: All-metal; stressed skin wings with main and auxiliary spars and spanwise stringers; bolted to fuselage; tip tanks permanently attached; rear fuselage detachable by four bolts for engine access.

LANDING GEAR: Hydraulically retractable tricycle type with oleo-pneumatic shock-absorbers, suitable for operation from semi-prepared runways. Hydraulically steerable nosewheel retracts forward; main units retract outward into wings. Low-pressure mainwheel tubeless tyres size 545×175-10 (14 ply); nosewheel tubeless tyre size 380×150-4 (6 ply). Emergency extension system. Hydraulic disc brakes with anti-skid system. Minimum ground turning radius 8.63 m (28 ft 3¾ in).

POWER PLANT: One Rolls-Royce Viper Mk 632-43 turbojet, rated at 17.79 kN (4,000 lb st). Fuel in two-cell rubber fuselage tank, capacity 781 litres (206 US gallons; 172 Imp gallons), and two wingtip tanks with combined capacity of 1,000 litres (264 US gallons; 220 Imp gallons). Total internal usable capacity 1,781 litres (470.5 US gallons; 392 Imp gallons). Self-sealing tanks optional. Single-point pressure refuelling point in port side of fuselage, below wing trailing-edge. Gravity refuelling points on top of fuselage and each tip tank. Provision for two drop tanks, each of 330 litres (87.1 US gallons; 72.6 Imp gallons) usable capacity, on centre underwing stations. Optional refuelling probe on starboard side of cockpits.

ACCOMMODATION: Crew of two in tandem, on Martin-Baker Mk 10LK zero/zero ejection seats in pressurised cockpit. Independent or rear-seat command ejection. Design in accordance with MIL-STD-203F. Rear seat elevated 32.5 cm (1 ft 1 in). Rearview mirror for each occupant. Two-piece moulded transparent canopy, opening sideways to starboard.

SYSTEMS: Pressurisation system maximum differential 0.24 bar (3.5 lb/sq in); cockpit designed for 40,000 pressurisation cycles. Bootstrap-type air conditioning system, also providing air for windscreen and canopy demisting. Hydraulic system, pressure 172.5 bar (2,500 lb/sq in), for actuation of flaps, aileron servos, airbrake, landing gear, wheel brakes and nosewheel steering. Back-up system for wheel brakes and emergency extension of landing gear. Main electrical DC power from one 28 V 9 kW engine-driven starter/generator and one 28 V 6 kW secondary generator; power distribution via five 28 V busses. Two 25 V 24 Ah Ni/Cd batteries for engine starting. Fixed-frequency 115/26 V AC power from two 600 VA single-phase static inverters; provision for additional inverter for three-phase AC. External power receptacle. Low-pressure demand oxygen system, operating at 28 bar (400 lb/sq in). Anti-icing system for engine air intakes.

AVIONICS: Representative fit includes following:

Comms: Honeywell AN/APX-100 IFF; Elmer SRT-651/N VHF/UHF transceiver.

Flight: Honeywell H-746-G GPS/INS, Rockwell Collins ADF-462 and VIR-432

VOR/ILS/MKR; Thales AN-490 tacan.

Instrumentation: Three MFDs; Thales LCD each cockpit; Alenia/Honeywell radalt.

Mission: Kaiser Sabre head-up display; Logic stores management system; Sekay video camera.

Self-defence: Optional RWR, chaff/flare dispenser and MAWS.

ARMAMENT: Up to 1,814 kg (4,000 lb) of external stores on six underwing hardpoints. Four inner hardpoints each stressed for up to 454 kg (1,000 lb) load, and two outer hardpoints each for up to 340 kg (750 lb) load. RNZAF aircraft fitted for AIM-9 Sidewinder and AGM-65 Maverick. Provision on two inner stations for installation of two Macehi gun pods, each containing either a 30 mm DEFA 553 cannon with 120 rounds or a 12.7 mm AN/M-3 machine gun with 350 rounds.

Other typical loads can include two Magic or AIM-9 Sidewinder air-to-air missiles on two outer stations; six general purpose or cluster bombs of appropriate weights; six AN/SU-11A/A 7.62 mm Minigun pods, each with 1,500 rounds; six Matra 155 launchers, each for eighteen 68 mm rockets; six AN/LAU-68/A or AN/LAU-32G launchers, each for seven 2.75 in rockets; six Aerea AL-25-50 or AL-18-50 launchers, each with twenty-five or eighteen 50 mm rockets respectively; six Aerea AL-18-80 launchers, each with twelve 81 mm rockets; four AN/LAU-10/A launchers, each with four 5 in Zuni rockets; four TDA 100-4 launchers, each with four 100 mm TDA rockets; six Bristol Aerospace LAU-5002 launchers for CRV-7 high-velocity rockets; six Aerea BRD bomb/rocket dispensers; six Aermacchi 11B29-003 bomb/flare dispensers; six TDA 14-3-M2 adaptors, each with six BAP 100 anti-runway bombs or BAT 120 tactical support bombs. Marte 2A anti-ship missile completed MB-339 qualification trials in February 1995.

Following data are for MB-339CD.

DIMENSIONS, EXTERNAL:

Wing span over tip tanks	11.22 m (36 ft 9¾ in)
Wing aspect ratio	6.5
Length overall	11.24 m (36 ft 10½ in)
Height overall	3.945 m (12 ft 11¼ in)
Elevator span	4.16 m (13 ft 7¾ in)
Wheel track	2.48 m (8 ft 1¾ in)
Wheelbase	4.37 m (14 ft 4 in)

AREAS:

Wings, gross	19.30 m² (207.7 sq ft)
Ailerons (total)	1.33 m² (14.32 sq ft)
Trailing-edge flaps (total)	2.55 m² (27.45 sq ft)
Airbrake	0.52 m² (5.60 sq ft)
Fin	2.21 m² (23.78 sq ft)
Rudder, incl tab	0.68 m² (7.32 sq ft)
Tailplane	3.38 m² (36.38 sq ft)
Elevators (total incl tabs)	0.98 m² (10.55 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	3,335 kg (7,352 lb)
Max weapon load	1,814 kg (4,000 lb)
Max fuel weight: internal	1,430 kg (3,153 lb)
external	530 kg (1,168 lb)

MB-339 PRODUCTION

Customer	Variant	Qty	First Aircraft	First Delivered
Argentine Navy	AA	10 ²	0761	1980
Eritrean Air Force	CE	6	409 ³	Apr 1997
Ghana Air Force	A	2	G800	1987
		2	G802	1994
Italian Air Force	A ¹	80	MM54438	19 Feb 1979
		20	MM54533	1986
		4	MM55052	1994
		2	MM55058	1995
	CD	15	MM55062	18 Dec 1996
		15	MM55077	Sep 2002
Malaysian Air Force	AM	13	M34-01	1983
	CM	8	M34-14	2008
New Zealand Air Force	CB	18	NZ6460	13 Mar 1991
Nigerian Air Force	AN	12	301	Jun 1984
Peruvian Air Force	AP	16	452	Nov 1981
UAE (Dubai) Air Force	A	2	431	24 Mar 1984
		5	433	1987
Subtotal		230		
Prototypes		2	MM588	1976
Demonstrator	A	1	I-NEUN	1980
	B	1	I-GROW	1984
	C	1	I-AMDA	1985
	K	1	I-BITE	1980
Total		236		

¹ Also 339PAN and 339RM
² One converted to JPATS demonstrator N339L; others lost or withdrawn from service
³ Eritrean aircraft serial numbered in reverse order

T-O weight, clean	4,950 kg (10,913 lb)
Max T-O weight with external stores	6,350 kg (14,000 lb)
Max wing loading	329.0 kg/m ² (67.39 lb/sq ft)
Max power loading	357 kg/kN (3.50 lb/lb st)
PERFORMANCE (at trainer clean T-O weight, except where indicated):	
Never-exceed speed (VNE)	M0.82 (500 kt; 926 km/h; 575 mph)
Max level speed at S/L:	
clean	470 kt (870 km/h; 541 mph)
with four 500 lb bombs	440 kt (815 km/h; 506 mph)
Max level speed at 9,140 m (30,000 ft)	M0.77 (441 kt; 815 km/h; 508 mph)
Max speed for landing gear extension	175 kt (324 km/h; 202 mph)
T-O speed	100 kt (185 km/h; 115 mph)
Approach speed over 15 m (50 ft) obstacle	102 kt (189 km/h; 117 mph)
Stalling speed, 20% fuel	86 kt (160 km/h; 99 mph)
Max rate of climb at S/L	1,631 m (5,350 ft)/min
Service ceiling	13,715 m (45,000 ft)
T-O run	620 m (2,035 ft)
Landing run at S/L, 20% fuel	480 m (1,575 ft)
Radius of action, 10% reserves:	
with four 500 lb bombs:	
lo-lo-lo	156 n miles (289 km; 179 miles)
hi-lo-hi	278 n miles (515 km; 829 miles)
with two rocket launchers two gun pods and two gun pods, 5 min combat, hi-lo-hi	280 n miles (519 km; 322 miles)
Ferry range, clean	1,122 n miles (2,078 km; 1,291 miles)
Max endurance with drop tanks	3 h 50 min
g limit	+8.0/-4.0

AERMACCHI M-346

TYPE: Advanced jet trainer/light attack jet.
PROGRAMME:

DEVELOPMENT MILESTONES

Design began	Jan 00
Announced	25 Jul 00
Rollled out (unofficially)	6 Jun 03
Rollled out	7 Jun 03
First flight	15 Jul 04

Announced 25 July 2000. Comprehensively redesigned and westernised version of Yakovlev Yak-130, on which Aermacchi had begun autonomous full-scale development in January 2000, conforming to requirements of Eurotrainer group. Three prototypes as follow-on to 300 trial flights with prototype Yak-130; mockup first shown at Paris, June 2001; maiden flight of P01/CMX615 scheduled for November 2003, following 7 June 2003 roll-out, but not achieved until 15 July 2004. Official (VIP) presentation 11 October 2004, by which time 11 hours amassed in 14 sorties. Total 50 sorties and 55 hours by 7 March 2005, when flown for first time with both FADECs operational.

P02/CMX616 first flew 17 May 2005. Both aircraft shown (001 flying) at Paris, 13 to 19 June 2005. On 9 January 2006, Aermacchi announced initial flight by M-346 (P02) with AFCS in full-authority mode. LRIP 00 (to production standard) to fly in late 2006, three aircraft contributing to 700-hour test programme. A01 initial production aircraft to fly in late 2007 (preceded by static test and fatigue test airframes to production standard in 2005 and 2006, respectively).

Aermacchi shares design rights and has production and modification rights for the Yak-130. Development of the aircraft was transferred to Italy in mid-1998 to prevent further delays resulting from the economic situation in Russia. Some funding provided by Italian Ministry of Industry. Italian military flight test centre (RSV) involved in certification testing, beginning with prototype's fourth sortie. Dott Massimo Luchesini is Aermacchi's AEM/Yak-130 programme director.

At Farnborough International, immediately following maiden flight, Aermacchi formally launched quest for industrial partners to share manufacture of any production aircraft. On 19 January 2005, Greek Ministry of Defence signed MoU for possible industrial participation in M-346; this confirmed with second MoU on 19 January 2006, giving Greece 10 per cent workshare, including design, production and assembly of several components, including rear fuselage.

CURRENT VERSIONS (SPECIFIC): **P01:** 001/CMX615. First flight 15 July 2004. Handling and performance trials, including envelope expansion, high AoA and FCS proving.

P02: 002/CMX616. As P01, plus avionics testing, including onboard simulation, and flight refuelling. Fuselage removed from assembly jig on 11 December 2003. First flight 17 May 2005.

LRIP 00: Avionics (including onboard simulation), definitive main landing gear, radar integration, electronic warfare and external stores trials. Following early flight trials of P01, decided in late 2004 to incorporate modified fuel system to eliminate sloshing and add further 40 litres (10.6 US gallons; 8.8 Imp gallons) of capacity.

CUSTOMERS: None. Estimated 600 sales in total market for 1,650 aircraft of this type over 25 years (2004).

DESIGN FEATURES: Extends flight envelope of existing jet trainers, notably turn and climb performance and usable AoA (40°). Related considerations are transonic aerodynamic configuration, twin-engine reliability, FBW control system, fighter-type cockpit and avionics, high reliability and low operational and maintenance costs. Able to 'download' some 30-40 per cent of training hours previously flown on combat aircraft at OCU.

Cockpit based on latest combat aircraft, such as Eurofighter Typhoon. 'Duck's beak' chine deleted from forward fuselage to simplify shape and facilitate optional addition of radar. Autonomous operation made possible by self-starting, OBOGS, BITE, APU and use of standard support equipment. Design to MIL-STD-1350A and MIL-A-8660A; maintenance to MIL-STD-470B; technical publications in accordance with applicable MIL-STD. Service life 16,000 hours. Wing dihedral 1°; tailplane anhedral 4°. Max sustained turn rate of 14.5°/s and load factor of 5.6 g, both at 4,570 m (15,000 ft).

FLYING CONTROLS: FBW. Ailerons, elevators and rudder on primary control circuit, protected against double failure, leading-edge flaps, double-slotted, constant chord trailing-edge flaps and spine airbrake on secondary control circuit, although first-mentioned are duplex. Smiths Aerospace primary actuators. Microtecnica actuators for leading- and trailing-edge flaps are rotary and ballscrew type, respectively. Airbrake failure mode is 'closed'.

STRUCTURE: Aluminium alloy skins, wings and fin; reinforced carbon fibre cockpit section and rear fuselage; metallic bonded composites ailerons, flaps, airbrake, rudder and elevons; Kevlar fin fillet, fin root fairings and tailcone; glass fibre nosecone and fin tip. Low parts-count: is 2 t heavier than MB-339, but has 40 per cent fewer parts.

Wing comprises three main spars and two auxiliary spars with integral fuel tank. Main spars pick up one to three single-three machined mainframes.

LANDING GEAR: Nosewheel leg by Liebherr; tyre 18x5.5. Forward-retracting mainwheel legs from AMX fighter-bomber on first two prototypes; new units by Liebherr thereafter; tyres 24x8. Hydraulic actuation; two emergency accumulators.

POWER PLANT: Two 27.9 kN (6,280 lb st) Honeywell FJ24-GA-200 twin-shaft turbofans with dual-channel FADEC. Total fuel capacity of first two prototypes approximately 2,500 litres (660 US gallons; 550 Imp gallons), comprising 394 litres (104 US gallons; 86.7 Imp gallons) in two-section tanks in each wing; main 1,493 litre (394 US gallon; 329 Imp gallon) centre fuselage tank; and 219 litre (57.9 US gallon; 48.2 Imp gallon) collector tank. Single-point pressure refuelling: can be refuelled with engines running. Two inboard wing pylons 'wet', each with provision for 580 litre (153 US gallon; 128 Imp gallon) tank. Secondo Mona fuel system. Optional, removable refuelling probe.

ACCOMMODATION: Two Martin-Baker Mk 16D zero/zero ejection seats. HOTAS controls.

SYSTEMS: Teleavio/BAE Systems quadruplex, full authority reprogrammable FCS provides stability augmentation throughout flight envelope. Autopilot is part of FCS. Honeywell Normelair-Garrett environmental control system, providing 100 per cent conditioned air to cockpit, using engine or APU power; 'bootstrap' air cooler, pre-cooler and dual heat exchangers, plus bleed leak detector; nominal cockpit pressure differential 0.25 bar (3.6 lb/sq in); Air Liquide OBOGS. Electrical system, by ASE and Logic, includes 20 kVA generator on each engine (100 per cent redundancy), two 9 kW transformer-rectifiers, one 5 kW 28 V DC emergency generator (Microturbo Rubis APU) and two Ni/Cd batteries. APU cleared for air-starts up to 6,100 m (20,000 ft); provides environmental control at 7 kg/s (15 lb/s) at 4.4 bar (64 lb/sq in) and 5 kW electrical power.

Two dual-redundant digital databusses conforming to MIL-STD-1553B: Avionics 1 for sensors and displays; Avionics 2 for radar, SMS, FLIR, AECM, RWR and HMD. Additional Armament databus to MIL-STD-1760 for weapons stations and SMS. Avionics 1 and 2 control is by mission computer symbol generator (MCSG) with failure back-up from miscellaneous computer (MISCO). Armament bus control by SMS acting as remote terminal of Avionics 2 bus. Air-to-air and air-to-ground attack computations by operational flight program (OFF) software in MCSG, latter also generating HUD symbology. Area navigation and flight director functions performed by embedded GPS inertial unit (EGI) and flight control computers, respectively.

Cockpit video recording provided by colour HUD TV camera, recording outside world with HUD symbology superimposed; associated VTR captures colour and monochrome



Prototype Aermacchi M-346 in June 2005, following repainting for Paris Air Show

1127755

video signals and is remotely controlled by a dedicated panel. MISCO also responsible for avionics system interface, aural warning generator for voice alert system (VAS), HUMS and gear down/locked confirmation tone. Crash-survivable memory unit (CSMU) interfaced via RS-422 to MISCO and audio system to record data for accident analysis. Two independent hydraulic systems by Microtecnica, both operating at 207 bar (3,000 lb/sq in): No.1 for flight controls, No. 2 for utilities and flight control back-up. Smiths/Microtecnica/OMA control surface actuators.

AVIONICS: Mission core system by Galileo Avionica.

Comms: Two Marconi VHF/UHF transceivers; Marconi IFF transponder, DbSystem intercom.

Radar: Provision in design.

Flight: Honeywell laser gyro INS with embedded GPS; Thales Tacan and Collins VOR/ILS/marker beacon receiver.

Instrumentation: Galileo Avionica raster/stroke HUD; three Galileo Avionica 127 × 127 mm (5 × 5 in) colour LCDs per cockpit; provision for HMD and NVGs. Up-front control panels for management of navigation and weapon delivery, communication, identification and radio navigation, plus optional FLIR.

Mission: Data transfer unit (DTU) for loading of mission plan. Centreline attachment for Vinten Viecon 19 reconnaissance pod, Litening FLIR, or ATLAS targeting pod. Cockpit video recorder, Radar and ECM simulation system integrated for advanced training.

Self-defence: Provision for RWR, chaff/flares and underwing ECM pod.

ARMAMENT: Nine hardpoints: one on centreline, rated at 600 kg (1,323 lb); four under each wing, rated at 1,050 kg (2,315 lb) (inboard), 550 kg (1,213 lb), 300 kg (661 lb) and 150 kg (331 lb) (wingtip). Optional cannon pod on centreline. Typical weapon loads include six Mk 82 (500 lb), four Mk 83 (1,000 lb) or two Mk 84 (2,000 lb) bombs; four GBU-12 (500 lb), GBU-16 (1,000 lb) or Opher Mk 82 guided bombs; six Rockeye or four BL 755 CBU's; six Durandal anti-runway dispensers; four BRD-4 or LAU-7/LAU-5002/LAU-32 rocket pods; four AIM-9 Sidewinder AAMs; four AGM-65 Maverick ASMs; or four Brimstone anti-armour missiles.

DIMENSIONS, EXTERNAL:

Wing span	9.72 m (31 ft 10¾ in)
Wing chord: at root (fuselage c/l)	3.87 m (12 ft 8¼ in)
at tip	0.97 m (3 ft 2¼ in)
mean aerodynamic	2.71 m (8 ft 10¾ in)

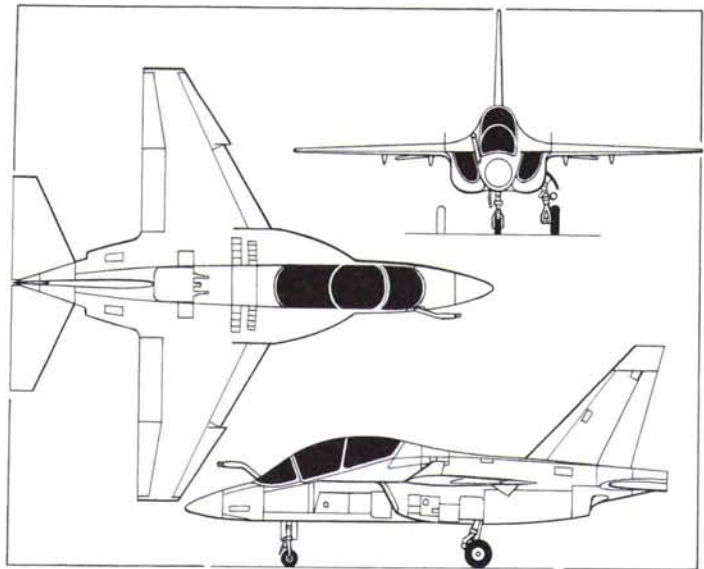


Second Aermacchi M-346 flying in full-authority AFCS mode in January 2006

1154289

For details of the latest updates to *Jane's All the World's Aircraft* online and to discover the additional information available exclusively to online subscribers please visit jawa.janes.com

Wing aspect ratio	4.0
Length overall	11.49 m (37 ft 8¼ in)
Height	4.76 m (15 ft 7½ in)
Tailplane span	4.83 m (15 ft 10¼ in)
Wheelbase	4.465 m (14 ft 7¾ in)
Wheel track	2.71 m (8 ft 10¾ in)
AREAS:	
Wings, gross	23.52 m ² (253.2 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	4,610 kg (10,163 lb)
Max weapon load	3,000 kg (6,614 lb)
Max internal fuel weight	2,000 kg (4,409 lb)
Max T-O weight: trainer	6,700 kg (14,771 lb)
attack	9,500 kg (20,943 lb)
Max wing loading: trainer	284.9 kg/m ² (58.34 lb/sq ft)
attack	403.9 kg/m ² (82.73 lb/sq ft)
Max power loading: trainer	120 kg/kN (1.18 lb/lb st)
attack	171 kg/kN (1.68 lb/lb st)
PERFORMANCE:	
Limiting speed	572 kt (1,059 km/h; 658 mph) EAS/M1.2
Max level speed at 1,525 m (5,000 ft)	590 kt (1,093 km/h; 679 mph)
Stalling speed, flaps down: full fuel	103 kt (191 km/h; 119 mph)
20% fuel	90 kt (167 km/h; 104 mph)
Max rate of climb at S/L	6,100 m (20,000 ft)/min
Service ceiling	13,715 m (45,000 ft)
T-O run	320 m (1,050 ft)
Landing run	470 m (1,545 ft)
Radius of action:	
air combat training with ACMI pod and one SRAAM, 40 min manoeuvring	120 n miles (222 km; 138 miles)
combat air patrol, two SRAAM, gun pod, plus two external fuel tanks, 2 h loiter	165 n miles (306 km; 190 miles)
close air support, hi-lo-lo-hi, two rocket pods, two ASMs, two SRAAM, gun pod	270 n miles (500 km; 311 miles)



General arrangement of Aermacchi M-346 (James Goulding) 1158241

interdiction, hi-lo-lo-hi, two Mk 83 bombs, two SRAAM, three external fuel tanks 450 n miles (833 km; 518 miles)

Range, 10% reserves:

with max internal fuel	1,120 n miles (2,074 km; 1,288 miles)
with three external tanks	1,540 n miles (2,852 km; 1,772 miles)
g limits	+8/-3

ALENIA

ALENIA AEROSPAZIO
(A FINMECCANICA COMPANY)

Via Giulio Vincenzo Bona 85, I-00156 Roma
Tel: (+39 06) 41 72 31
Fax: (+39 06) 411 44 39
Web (1): www.finmeccanica.com
Web (2): www.alenia-aeronautica.it
PRESIDENT: Giorgio Zappa
SENIOR VICE-PRESIDENT, HEAD OF STRATEGY AND MILITARY PROGRAMMES: Carmelo Cosentino
SENIOR VICE-PRESIDENT, OPERATIONS: Gianni Cantini
HEAD OF AERONAUTICS DIVISION: Filippo Bagnato
SENIOR VICE-PRESIDENT, TECHNICAL AND PRODUCTION FACILITIES, AERONAUTICS DIVISION: Giuseppe Ragni
MARKETING COMMUNICATIONS OFFICER: Riccardo Rovere

Alenia Aerospazio, a Finmeccanica company, is the leading Italian aerospace designer and manufacturer. Employees total 12,000, engaged on projects and programmes for civil and military applications. Alenia Aerospazio is organised into two Divisions: Aeronautics and Space (Alenia Spazio SpA). On 14 April 2000, it signed a joint venture agreement with EADS to form the European Military Aircraft Company (EMAC), but early establishment was not achieved and intermittent discussions continued into 2002 before being abandoned. In January 2003, Alenia declined to take up offered 5 per cent stake in Airbus, but instead signed wide-ranging collaborative agreement with Boeing, with specific areas to be decided by committee formed in 2003.

Aeronautics Division (Alenia Aeronautica) dedicated to full range of activities, from design and production to modification and product support for both military and civil aircraft; most entail collaboration with other aerospace companies; in 2002, division had 7,173 employees and conducted almost half of its activities in the military sphere.

Division's activities fall into categories of Military Aircraft, Regional Aircraft and Aerostructures. It also operates Officine Aeronavali Venezia, specialising in maintenance, overhaul and modification of commercial and military aircraft.

In military sector, company designs and produces directly, or through international collaborations, combat and transport aircraft such as Tornado, Eurofighter Typhoon, C-27J, A400M and ATR 42 MP Surveyor; was also responsible for assembling AV-8B Harrier II Plus for the Italian Marina Militare.

In regional aircraft sector, activities include production of the ATR turboprop family developed with Aerospaziale Matra.

In the aerostructures sector, Alenia co-operates with other major aeronautical companies manufacturing structural parts for commercial aircraft such as B767, B777, B787, A321, A300/310, A330/A340, Falcon 900EX and Falcon 2000. Is 4 per cent risk-sharing partner in Airbus A380 programme, responsible for a fuselage section.

In the modification and maintenance field, Alenia Aerospazio has a full capability of design, production, installation and tests of complex parts and systems. DOMA (Design Organisation Military Approval) certification for C-27J was awarded on 1 March 2006.

ALENIA C-27J SPARTAN

TYPE: Twin-turboprop transport.
PROGRAMME:

DEVELOPMENT MILESTONES

G.222	
First flight	18 Jul 70
First flight, pre-production	23 Dec 75
First delivery (Dubai AF)	21 Nov 76
Subsequent versions	
C-27J	

Design began	Sep 96
Programme launched	17 Jun 97
Announced	Feb 96
Rolled out	14 Jun 99
First flight	24 Sep 99
Certification	20 Jun 01
First flight, production	12 May 00

Conceived in 1960s as jet-powered, V/STOL transport to NATO requirement (NBMR-4), but this version not developed. Original Fiat G222 designed by Giuseppe Gabrielli; two prototypes (lacking the pressurisation standard on later aircraft) flew on 18 July 1970 (MM582) and 22 July 1971 (MM583), both at Turin; MM582 handed over to Italian Air Force for operational evaluation on 21 December 1971. First production G222 (MM62101) flew 23 December 1975; deliveries began 21 November 1976 with single aircraft to Dubai, and to Italy on 21 April 1978. Tenth production aircraft was first to be built at Naples; 27th (March 1979) was 22nd and last built at Turin. Main users in Italy are 2nd and 98th Gruppi of the 46^a Brigata Aerea at Pisa. Civil category R (equivalent to FAR Pt 25) certification granted to G222SAA by Italian airworthiness authority on 1 April 1997. Several subvariants for specific roles.

Improved version of G222 conceived during 1995 negotiations between Lockheed Martin and Alenia on potential offsets for proposed Italian purchase of C-130J Hercules; initially designated G222J, by reason of having C-130J flight deck features and improved (T64G) versions of the G222's engines with new four-blade propellers. Formally announced as a joint project in February 1996, when commonality with the C-130J was further increased by adoption of the Allison (now Rolls-Royce) AE 2100 as power plant, allied to six-blade propellers. Accordingly redesignated C-27J, to reflect the C-27A version of G222 delivered to the US Air Force. Feasibility phase February to September 1996; definition phase September 1996 to May 1997.

Development and certification costs being shared equally between Alenia Aerospazio and Lockheed Martin; latter responsible for propulsion systems, avionics, worldwide marketing and product support; Alenia for production, flight test and certification; promotion by Lockheed Martin Alenia Tactical Transport Systems. By 2003, Lockheed Martin was seeking reduced participation through voluntary relegation to subcontractor. Accordingly, Global Military Aircraft Systems (GMAS) formed 21 April 2005 as joint venture by Alenia Aeronautica and L-3 Communications with near-term objective of promoting C-27J for US Army and National Guard requirements. GMAS was augmented in April 2006 by Boeing Integrated Defense Systems. C-27J promoted in 2006 for Canadian Fixed Wing Search and Rescue programme, valued at CAD1.3 billion for procurement, plus 20-year support contract.

C-27J programme formally launched on 17 June 1997; 'propulsion test' prototype, a converted G222 demonstrator, rolled out at Turin/Caselle on 14 June 1999 and first flew (c/n 4043; I-CERX) 24 September 1999; initial testing completed second quarter of 2000; modified for certification trials and resumed flying on propulsion system, performance and handling evaluation.

Second C-27J and initial new-build aircraft, 4115/I-FBAX, first flew 12 May 2000; first with advanced flight deck and full avionics, new APU and new landing gear; achieved 54 hours/23 sorties in initial two months; available for sale after completion of civil certification trials. Third prototype, 4033/MMCSX62127, converted from Italian Air Force G222TCM, first flew 8 September 2000 returned to IAF after DGAA civil certification, which achieved on 20 June 2001. Military type certificate awarded 20 December 2001, following 445 sortie, 793 hour programme. First two batches, totalling 10, under construction (long lead items) by 1999. Final assembly remains in Italy only. First new-built export C-27J was Greek AF 4117 (temporarily CSX62231 for testing in Italy), first flown 15 December 2004.

CURRENT VERSIONS: **Transport:** As described.

AEW: Airborne early warning version proposed in 1998, employing Ericsson Erieye system, as fitted to Saab S 100B Argus.

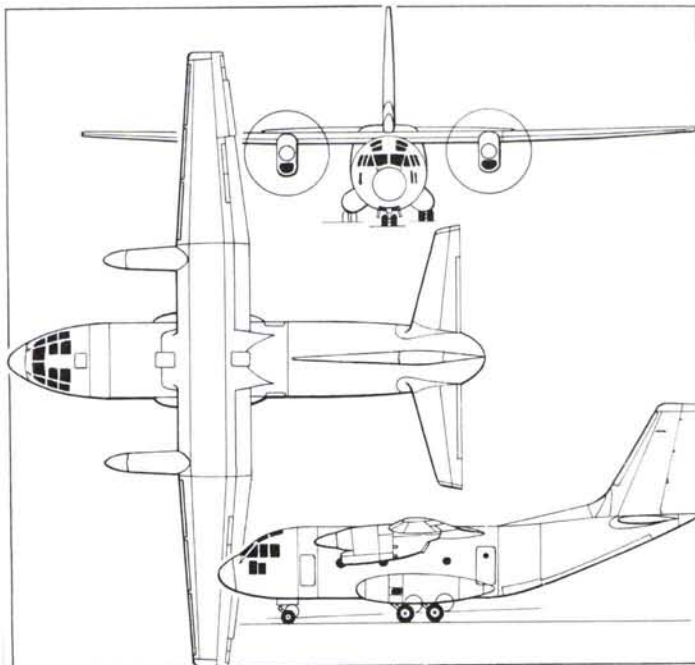
Firefighter: Proposed with 2,200 kg (4,850 lb) mission system and 6,800 kg (14,991 lb) of retardant liquid.

Aerial Sprayer: Proposed with 2,200 kg (4,850 lb) mission system; capable of covering 50 hectares (124 acres) at 150 litres/hectare (16.0 US gallons; 13.0 Imp gallons/acre).



Alenia C-27J Spartan during demonstrations in Canada

1159015



Alenia/Lockheed Martin C-27J Spartan, showing 'kneeling' position of landing gear (James Goulding)

1159584

Maritime: Patrol version under consideration by Taiwan in 2003 as alternative to Lockheed Martin P-3 Orion anti-submarine aircraft.

CUSTOMERS: See table. Italian Air Force announced proposed launch order for 12 on 11 November 1999, although this not signed until 27 June 2002 and for initial quantity of five; deliveries planned to begin in mid-2005 and be completed in late 2006, but programme deferred by some 12 months and first aircraft not flown until July 2006.

Greek Air Force selected C-27J on 1 March 2002, proposing 12 plus three options, and signed contract for 12 on 17 January 2003; deliveries to begin in 2004 and end 12 months later, but first aircraft not flown until 15 December 2004, deliveries beginning to 354 Squadron at Elefsis on 4 August (formal hand-over in Italy, 22 March) 2005 (eight due that year) and concluding in 2006 (four). However, by mid-2006 it appeared that the schedule had not been met.

Bulgaria announced proposal order in April 2005 for eight, although with only two deliverable in 2006 and two in 2007, balance depending upon financial issues. Formal order signed 24 February 2006 for five, with option on further three; deliveries to begin in June 2007 and continue at one per year. Lithuania ordered three on 26 June 2006 for delivery in 2006 and 2007.

Up to 500 sales anticipated over a 20 year period, mostly to existing Hercules operators. Lockheed Martin co-markets the aircraft. Sales targets include Argentina, Brazil (12), Canada (15 for SAR) and Taiwan (18 to 22). Also promoted for US Army's 40-aircraft Aerial Common Sensor programme; to US Army National Guard (33) as Future Cargo Aircraft replacement for Shorts Sherpas; and to US Air Force as Combat Rescue Tanker for air- and forward ground refuelling of personnel recovery missions. Following delay of 12 months, US Army and Air Force planned December 2006 decision on combined purchase of re-named Joint Cargo Aircraft (JCA), involving up to 75 and 70 aircraft, respectively, with only C-27J and EADS CASA C-295 in contention. L-3 Integrated Systems is partner for US marketing through GMAS co-venture and delivered JCA proposal in June 2006. Announced 18 July 2006 that Cecil Field, Jacksonville, Florida, selected as US C-27J assembly site, if chosen, although initial aircraft would be from Italian manufacture.

COSTS: EUR24.75 million (Greek programme unit cost, 2003). JCA contract for 145 valued at USD6 billion (2006). Lithuanian programme unit cost EUR25 million (2006).

DESIGN FEATURES: Conventional tactical transport configuration of high wing, panner-mounted main landing gear and upswept rear fuselage with integral loading ramp.

Intended to complement the Lockheed Martin Hercules. Upgraded G222 with new, two-crew flight deck and increased performance. Propulsion system, cargo loading system and many of the avionics and flight controls are adapted from the C-130J Hercules. Compared with the G222, the C-27J is intended to provide increases of 35 per cent in range, 30 per cent cruise ceiling, 15 per cent high-speed cruise and over 200 per cent payload/range/speed; maintainability and reliability are scheduled to increase by 100 per cent for the engine, 275 per cent for propeller, 150 per cent for other systems and 30 per cent for avionics, resulting in a saving of 30 per cent in operating costs (including 5 per cent off fuel).

Wing has max thickness/chord ratio of 15 per cent. Dihedral 2° 30' on outer panels. **FLYING CONTROLS:** Conventional; manually actuated ailerons and rudder; powered elevators with digital Q-feel. Automatic rudder limitation as airspeed function. Ailerons each have inset trim tab outboard and spring tab inboard. Two-section hydraulically actuated spoilers in upper wing surface ahead of each outboard flap segment, used also as lift dumpers on landing. Double-slotted flaps, inboard and outboard sections, extend over 60 per cent of Trailing-edge. Spoilers and flaps fully powered by tandem hydraulic actuators. Rudder fully powered by tandem hydraulic actuators; 17 vortex-generators on port side of fin, ahead of rudder, to increase control effectiveness in engine failure mode. Two tabs in each elevator: geared tab inboard and trim tab outboard; no rudder tabs.

STRUCTURE: Wing of aluminium alloy three-spar fail-safe box structure, built in three portions. One-piece constant chord centre-section fits into recess in top of fuselage and is secured by bolts at six main points. Outer panels tapered on leading- and trailing-edges. Upper surface skins are of 7075-T6 alloy, lower surface skins of 2024-T3 alloy. All control surfaces have bonded metal skins with metal honeycomb core.

Pressurised fail-safe fuselage of aluminium alloy stressed skin construction and circular cross-section. Easily removable stiffened floor panels. Cantilever safe-life tail surfaces of aluminium alloy, with sweptback three-spar fin and slightly swept two-spar variable incidence tailplane.

Subcontractors include Aermacchi (outer wings), Piaggio (wing centre-section), Agusta (tail unit), Magnaghi (landing gear) and Aeronavali Venezia (airframe components).

LANDING GEAR: Hydraulically retractable tricycle type, suitable for use from prepared runways, semi-prepared strips or grass fields. Main gear built by APPH; nose gear by Magnaghi. Steerable twin-wheel nose unit retracts forward. Main units, each consisting of two single wheels in tandem, retract into fairings on sides of fuselage. Oleo-pneumatic shock-absorbers. Gear can be lowered by gravity in emergency, the nose unit being aided by aerodynamic action and the main units by the shock-absorbers, which remain compressed in the retracted position. Oleo pressure in shock-absorbers is adjustable to permit 50 cm (20 in) variation in height and 4° 20' in attitude of cabin floor from ground. Low-pressure tubeless tyres on all units, size 39x13 (14/16 ply) on mainwheels, 29x11.00-12 or 29x11.00-10 (10 ply) on nosewheels. Tyre pressures 4.41 bar (64 lb/sq in) on main units, 3.92 bar (57 lb/sq in) on nose unit. Hydraulic multidisc brakes.

POWER PLANT: Two Rolls-Royce AE 2100D2 turboprops, each rated at 3,458 kW (4,637 shp), driving Dowty R391 six-blade composites propellers. Fuel in integral tanks; two in outer wings, combined capacity 6,720 litres (1,775 US gallons; 1,478 Imp gallons); two centre-section tanks, combined capacity 5,600 litres (1,480 US gallons; 1,232 Imp gallons); crossfeed provision to either engine. Total normal fuel capacity 12,320 litres (3,255 US gallons; 2,710 Imp gallons). Optional extended range wing tanks with additional 1,520 litres (402 US gallons; 334 Imp gallons), increasing fuel load to 13,840 litres (3,656 US gallons; 3,044 Imp gallons). Single-point pressure- and four-point gravity refuelling; central defuelling; in-flight jettison at 333 litres (88.0 US gallons; 73.3 Imp gallons)/min. Optional refuelling probe and OBIGGS.

ACCOMMODATION: Two-pilot crew on flight deck with third seat; provision for loadmaster or jumpmaster when required. Crew door, port, forward; Type III emergency door, starboard, forward; paratroop door each side, immediately rear of sponsons; rear loading ramp; emergency hatches (three) in roof, above flight deck and level with leading- and trailing edges. Interior reconfiguration between troop transport, paratroop dropping, cargo, cargo air dropping and medical evacuation: role interchange time by one loadmaster between 10 and 48 minutes.

Standard troop transport version has 34 foldaway sidewall seats and 12 port-facing, centreline stowable seats for total of 46 fully equipped troops (68 in high density) lavatory.

G222 AND C-27 CUSTOMERS

Customer	Version	Qty	First aircraft	Delivered
Argentine Army	G222	3	AE260	29 Mar 1977
Bulgarian Air Force	C-27J	5		2007
Congo Air Force	G222	3		on order ⁴
Dubai Air Force	G222	1	321	21 Nov 1976
Greek Air Force	C-27J	12 ⁸	4117	4 aug 2005
Italy: prototypes	G222	2	MM582	21 Dec 1971
Air Force	G222TCM	40 ³	MM62101	Apr 1978
	C-27J	5 ⁷		2005
Air Force	G222RM	4	MM62139	Jan 1983
Air Force	G222VS	2	MM62107	1978
SNPC	G222PROCIV	5 ⁶	MM62145	1987
Libyan Air Force	G222T	20	221	1981
Lithuanian Air Force	C-27J	3		on order
Nigerian Air Force	G222	5 ⁹	950	Sep 1984
Somali Air Force	G222	2	AM-94	1980
Venezuelan: Army	G222	1 ¹	EV-8327	1983
Air Force	G222	6	1258	1984
Thai Air Force	G222	6	60307	2 May 1995
US Air Force	C-27A	10 ⁵	90-0170	17 Apr 1991
Alenia (demonstrator)	G222/C-27J	1	I-CERX	1983
	C-27J	1	I-FBAX	2000
Total		131²		

¹ Transferred to air force
² Prototypes and 22 early aircraft built at Turin; remainder at Naples
³ Including 10 with provision for rapid conversion to 222SAA; two to Tunisian Air Force 19 May 2001; C-27J purchase involves Alenia buy-back of 39 G222s for possible resale
⁴ Built, but awaiting completion of contractual details
⁵ Transferred to US government, with civil registrations, 1999
⁶ All reverted to transports in 2001
⁷ Plus seven options
⁸ Plus three options
⁹ To be refurbished in 2006-07 and augmented by one formerly operated by Italian Air Force

Paratroop transport can carry between 34 (normal) and 46 (maximum) fully equipped paratroops, and is fitted with 32 sidewall seats, plus eight stowable seats, door jump platforms and static lines. Cargo transport version can accept standard pallets of up to 2.24 m (88 in) wide comprising either three HCU-6/Es (2.74 m; 108 in wide) plus one HCU-12/E (1.37 m; 54 in wide); or seven HCU-12/Es. Hydraulically operated rear-loading ramp and upward-opening door in underside of upswept rear fuselage, which can be opened in flight for airdrop operations. Typical drop loads of up to 12 A22 CDS bundles; 6,000 kg (13,228 lb) single load or two 4,500 kg (9,921 lb) loads; or 5,000 kg (11,023 lb) LAPES load. Paratroop jumps can be made either from ramp or from rear side doors. Medical evacuation accommodation for 36 stretchers and six attendants. Lavatory with electric flushing. Entire accommodation pressurised, giving S/L pressure up to 4,040 m (13,260 ft), then 0.4 bar (5.8 lb/sq in) differential up to max operational altitude of 9,145 m (30,000 ft). Three oxygen converters providing 14 h 30 min supply for three crew, plus 2 h 30 min for 47 in cargo hold, all at 7,620 m (25,000 ft). Drinking water tank: 22 litres (5.8 US gallons; 4.8 Imp gallons).

SYSTEMS: Twin digital autopilot and flight director system, including stall warning and T-O configuration warning. Pressurisation system maintains S/L atmosphere up to 4,035 m (13,240 ft) and a cabin differential of 0.41 bar (5.97 lb/sq in) up to max operating altitude. Air conditioning system uses engine bleed air during flight; on ground, it is fed by compressor bleed air from APU to provide cabin heating to a minimum of 18°C. Hamilton Sundstrand APS1000 (T62T-46C16) 113 kW (152 hp) APU, installed in starboard main landing gear fairing, provides power for engine starting up to 6,705 m (22,000 ft), hydraulic pump and alternator actuation, air conditioning on ground, and all hydraulic and electrical systems necessary for loading and unloading on ground.

Two independent hydraulic systems, each of 207 bar (3,000 lb/sq in) pressure at 50 litres (13.2 US gallons; 11.0 Imp gallons)/min by engine-driven pump or half that rate by electric pump. No. 1 system actuates flaps, elevators, spoilers, steering, rudder, wheel brakes and (in emergency only) landing gear extension; No. 2 system actuates landing gear extension, retraction and ground attitude; rear ramp/door; lift-dumpers; and windscreen wipers. Auxiliary hydraulic system, fed by APU-powered pump, can take over from No. 2 system in flight, if both main systems fail, to operate essential services. In addition, a standby hand pump is provided for emergency use to lower the landing gear and, on the ground, to operate the ramp/door and parking brakes.

Three 60 kVA alternators, one driven by each engine through constant-speed drive units and one by the APU, provide 115/200 V three-phase AC electrical power at 400 Hz. 28 V DC power is supplied from the main AC busses via three 350 A transformer-rectifiers, with static inverter and two 24V 40 Ah Ni/Cd batteries for standby and emergency power. External AC power socket. Engine intakes anti-iced by electrical/hot air system. Pneumatically inflated de-icing boots on outer wing leading-edges, and fin and tailplane leading-edges, using engine bleed air; electrically heated windscreens. Liquid oxygen system for crew and passengers (with cabin wall outlets); 10 litre (0.35 cu ft) converter for three flight deck crew providing 14 h 30 min supply, plus two similar units providing 46 troops and loadmaster with 2 h 30 min supply; this system can be replaced by a gaseous oxygen system if required. Emergency oxygen system, comprising five cylinders, available for all occupants in the event of a pressurisation failure.

EQUIPMENT: Navigation/anti-collision lights operable in normal, covert (IR) and NVG modes. Hold cargo winch with remote control; two independent retrieval winches.

AVIONICS: Comms: Two ARC-210 U/VHF, two HF radios. Digital audio intercom. Cockpit voice recorder.

Radar: Northrop Grumman AN/APN-241 digital mapping radar with Doppler beam sharpening, weather and turbulence detection, air target detection, windshear detection and beacon mode.

Flight: TCAS II, GCAS. FANS compatible. Twin DME, twin VOR/ILS/MKR, low frequency ADF, dual radalt, embedded GPS/INS. Flight data recorder.

Instrumentation: Five-screen EFIS based on C-130J flight deck. NVG-compatible. Optional HUD and digital map.

Self-defence: Optional RWR, MAWS. LWR, DIRCM, chaff/flare dispensers and towed decoy.

DIMENSIONS, EXTERNAL:

Wing span	28.70 m (94 ft 2 in)
Wing aspect ratio	10.0
Length overall	22.70 m (74 ft 5½ in)
Height overall: unladen	10.57 m (34 ft 8¼ in)

fully laden	9.70 m (31 ft 10 in)
Fuselage: Max diameter	3.55 m (11 ft 7¾ in)
Tailplane span	12.40 m (40 ft 8¼ in)
Wheel track	3.67 m (12 ft 0½ in)
Wheelbase (to c/l of main units):	
unladen	6.23 m (20 ft 5¼ in)
fully laden	6.40 m (21 ft 0 in)
Propeller diameter	4.11 m (13 ft 6 in)
Distance between propeller centres	9.50 m (31 ft 2 in)
Propeller/fuselage clearance	1.04 m (3 ft 5 in)
Rear-loading ramp/door: Width	2.45 m (8 ft 0½ in)
Height	2.25 m (7 ft 4½ in)
Crew door: Width	0.70 m (2 ft 3½ in)
Height	1.52 m (4 ft 11¼ in)
Emergency door: Width	0.53 m (1 ft 8¾ in)
Height	1.01 m (3 ft 3¾ in)
Paratroop doors: Width	0.91 m (2 ft 11¼ in)
Height	1.92 m (6 ft 3½ in)
Emergency hatch:	
Flight deck: Width	0.70 m (2 ft 3½ in)
Length	0.50 m (1 ft 7¾ in)
Cabin (both): Width	0.63 m (2 ft 0¾ in)
Length	0.90 m (2 ft 11½ in)

DIMENSIONS, INTERNAL:

Main cabin: Length	8.58 m (28 ft 1¾ in)
Width	2.45 m (8 ft 0½ in)
Height	2.25 m (7 ft 4½ in)
Floor area: excl ramp	21.0 m ² (226 sq ft)
incl ramp	25.7 m ² (276 sq ft)
Volume	58.0 m ³ (2,048 cu ft)

AREAS:

Wings, gross	82.00 m ² (882.6 sq ft)
Ailerons (total)	3.65 m ² (39.29 sq ft)
Trailing-edge flaps (total)	18.40 m ² (198.06 sq ft)
Spoilers (total)	1.65 m ² (17.76 sq ft)
Fin (incl dorsal fin)	12.19 m ² (131.21 sq ft)
Rudder	7.02 m ² (75.56 sq ft)
Tailplane	19.09 m ² (205.48 sq ft)
Elevators (total)	4.61 m ² (49.62 sq ft)

WEIGHTS AND LOADINGS:

Operating weight empty	17,000 kg (37,479 lb)
Max payload: at 3.0 g	8,500 kg (18,739 lb)
at 2.5 g	9,000 kg (19,840 lb)
at 2.25 g	11,500 kg (25,353 lb)
airdrop: two/three HCU-6/E platforms	9,000 kg (19,842 lb)
single HCU-6/E platform	6,000 kg (13,228 lb)
LAPES	5,000 kg (11,023 lb)
Max normal fuel load	9,734 kg (21,460 lb)
Max T-O weight: logistical	31,800 kg (70,106 lb)
basic and tactical	30,500 kg (67,240 lb)
Max landing weight: logistical (2 m; 6 ft/s)	30,500 kg (67,240 lb)
tactical (3 m; 10 ft/s)	27,500 kg (60,627 lb)
Max cargo floor loading	1,500 kg/m ² (307.2 lb/sq ft)
Max wing loading	387.8 kg/m ² (79.43 lb/sq ft)
Max power loading	4.60 kg/kW (7.55 lb/shp)

PERFORMANCE:

Max level speed	315 kt (583 km/h; 362 mph)
Stalling speed	90 kt (167 km/h; 104 mph)
Time to 4,570 m (15,000 ft)	7 min
Initial cruising altitude	8,380 m (27,500 ft)
Max operating altitude	9,145 m (30,000 ft)
Service ceiling, OEI, 95% MTOW	4,420 m (14,500 ft)
T-O run: at logistic T-O weight	580 m (1,905 ft)
at tactical T-O weight	550 m (1,805 ft)

T-O to 15 m (50 ft)	640 m (2,100 ft)
Landing from 15 m (50 ft)	690 m (2,265 ft)
Landing run	340 m (1,115 ft)
Radius of action:	
with 46 paratroops	1,100 n miles (2,037 km; 1,265 miles)
with 5,000 kg (11,023 lb) airdrop load	1,215 n miles (2,250 km; 1,398 miles)
Range:	
with max payload	1,160 n miles (2,148 km; 1,334 miles)
with 10,000 t (22,046 lb) payload	1,000 n miles (1,852 km; 869 miles)

with 6,000 kg (13,228 lb) payload	2,301 n miles (4,262 km; 2,648 miles)
ferry	3,200 n miles (5,926 km; 3,682 miles)
g limits: at tactical weight	+3.0
at basic weight	+2.5
at logistical weight	+2.25
OPERATIONAL NOISE LEVELS:	
Flyover at full power	88 dB
Approach	95 dB
Sideline	89 dB

ALISPORT

ALISPORT SRL

Via Confalonieri 22, I-23894 Cremella
Tel: (+39 039) 921 21 28
Fax: (+39 039) 921 21 30
e-mail: info@alisport.com
Web: www.alisport.com

Alisport builds and markets the DEA-designed Yuma STOL lightplane as well as the Silent series of sailplanes. Related business includes sale of propellers and accessories.

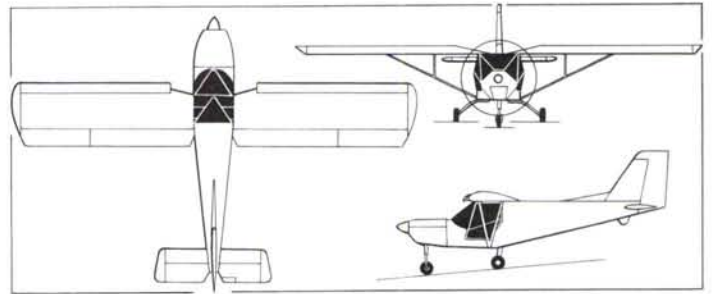
ALISPORT YUMA

TYPE: Side-by-side ultralight kitbuilt.
PROGRAMME: Development began 1994.
DESIGN FEATURES: Objectives included better performance than existing STOL light aircraft, but without sacrifice of cruising speed; effective and harmonised controls; foldable wings. High wings with V-struts; sweptback fin. Delivered as 85 per cent complete quick-build kit, less engine, propeller and instruments; quoted build time 200 hours.
FLYING CONTROLS: Conventional and manual. Large, cable-actuated control surfaces for effectiveness of response at slow speeds; 'spade'-type suspended aileron balance tabs. Flaps. Handley Page slats on wing leading-edge.
STRUCTURE: Generally of heat-treated and corrosion-proofed aluminium alloy; skins bonded before riveting. Welded tubular steel frame cockpit structure; steel alloy wing struts. Control surfaces covered in Dacron fabric. Wing leading-edge slats of carbon fibre. Composites tips to wing and empennage. Lexan windscreen; polycarbonate side windows.



Alisport Yuma ultralight kitplane operated in South Africa (Patrick Allen)

1110440



Alisport Yuma side-by-side ultralight (James Goulding)

0587527

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring cantilever mainwheel legs with optional speed fairings. Steerable, telescoping nosewheel leg. Hydraulic disc brakes. Optional amphibious floats.	
POWER PLANT: Choice of 59.6 kW (79.9 hp) Rotax 912 UL, 73.5 kW (98.6 hp) Rotax 912 ULS or 84.5 kW (113.3 hp) turbocharged Rotax 914 UL. Fuel in wing tanks and header tank, total capacity 87 litres (23.0 US gallons; 19.1 Imp gallons) of which 85 litres (22.5 US gallons; 18.7 Imp gallons) are usable. GT two-blade wooden propeller.	
EQUIPMENT: Optional glider towing hook and ventral baggage pod.	
DIMENSIONS, EXTERNAL:	
Wing span	9.75 m (31 ft 11¼ in)
Length overall	6.45 m (21 ft 2 in)
Height overall	2.45 m (8 ft 0½ in)
Tailplane span	2.80 m (9 ft 2¼ in)
Wheel track	1.74 m (5 ft 8½ in)
Wheelbase	2.00 m (6 ft 6¾ in)
DIMENSIONS, INTERNAL:	
Cabin max width	1.18 m (3 ft 10½ in)
AREAS:	
Wings, gross	13.44 m ² (144.7 sq ft)
WEIGHTS AND LOADINGS:	
Wing empty	282 kg (622 lb)
Max T-O weight	450 kg (992 lb)
Max wing loading	33.5 kg/m ² (6.86 lb/sq ft)
PERFORMANCE (Rotax 912 ULS engine):	
Never-exceed speed (VNE)	100 kt (185 km/h; 115 mph)
Cruising speed at 75% power	86 kt (160 km/h; 99 mph)
Stalling speed, power off:	
flaps up	30 kt (55 km/h; 35 mph)
flaps down	27 kt (50 km/h; 32 mph)
Max rate of climb at S/L	480 m (1,575 ft)/min
Service ceiling	5,000 m (16,400 ft)
T-O run	30 m (100 ft)
Landing run	55 m (180 ft)
Endurance	4 h 18 m

ALPI

ALPI AVIATION SRL

Via Brigata Osoppo 180, I-33070 Vigonovo di Fontanafredda
Tel: (+39 0434) 37 04 96
Fax: (+39 0434) 25 39 38
e-mail: info@alpiaviation.com
Web: www.alpiaviation.com
CHIEF DESIGNER: Corrado Rusalen

FACTORY:
Via dei Templari 24, I-33080 San Quirino, Pordenone

US DISTRIBUTOR:
Orlando Sanford Aircraft Sales
1920 E Airport Boulevard, Sanford, Florida 32773
Tel: (+1 800) 276 77 61 and (+1 407) 322 36 62
Fax: (+1 407) 322 47 72
Web: www.airplane4sale.com

Alpi Aviation was formed in 1999; its Alpi Pioneer 300S is a development of the Asso V, designed by Vidor Guiseppe and formerly marketed by Rusalen & Rusalen. German marketing is by Flugtechnik at Damme. Alpi also produces the all-wood Pioneer 200, aerobatic Pioneer 330 and Pioneer 300 Hawk, with improved aerodynamics. Alpi has a 5,000 m² (53,820 sq ft) factory at Pordenone; wooden components are sourced from a 3,000 m² (32,290 sq ft) facility in Croatia. US LSA approval procedure began in 2005.

ALPI PIONEER 200

TYPE: Side-by-side kitbuilt.
PROGRAMME: Introduced 2001; draws on experience gained from Pioneer 300, meeting JAR-VLA requirements. French certification achieved 2003, followed by German BFU certification in early 2005.

CURRENT VERSIONS: **Pioneer 200 Standard:** Baseline model; as described.

Pioneer 200 Sauer: As Standard, but with 48.5 kW (65 hp) Sauer engine.

Pioneer 200 Sparrow: As Standard, but with 73.5 kW (98.6 hp) Rotax 912 ULS and redesigned instrument panel.

Pioneer 200 Beluga: Utility version with port-side-hinged upper rear fuselage giving access to large baggage compartment.

CUSTOMERS: At least 97 produced by 2006. Exports include aircraft to Australia, Canada, New Zealand, the United States and most European Union countries.

COSTS: Kit EUR16,780; ready-to-fly EUR39,890 (2006).

DESIGN FEATURES: Derived from Pioneer 300, but with more upright fin, constant-chord wing and fixed landing gear. Quoted build time 500 hours.

FLYING CONTROLS: Conventional and manual. Ailerons externally mass-balanced. Flight-adjustable tab in port elevator. Electrically operated flaps.

STRUCTURE: Fuselage of spruce with plywood skin overlaid with Dacron, except for fabric-covered elevators and rudder. Wing spar of spruce with plywood skin to leading-edge; remainder, including ailerons and flaps, fabric covered; shortened (7.04 m; 23 ft 1¼ in) wing optional. Single-piece, forward-hinged canopy; glass fibre engine cowling.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, tube metal spring cantilever mainwheel legs. Composites wheel fairings optional. Rubber-in-compression nosewheel shock absorber.

POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL flat-four driving two-blade fixed-pitch propeller; 48.5 kW (65 hp) Sauer four-stroke driving a two-blade, fixed-pitch propeller in Pioneer 200 Sauer version or 59.7 kW (80 hp) Jabiru 2200 and two- or three-blade variable pitch propeller. Fuel capacity 54 litres (14.3 US gallons; 11.9 Imp gallons), of which 50 litres (13.2 US gallons; 11.0 Imp gallons) are usable, in single centrally positioned fuel tank; optional 17 litre (4.5 US gallon; 3.7 Imp gallon) auxiliary tank can be fitted.

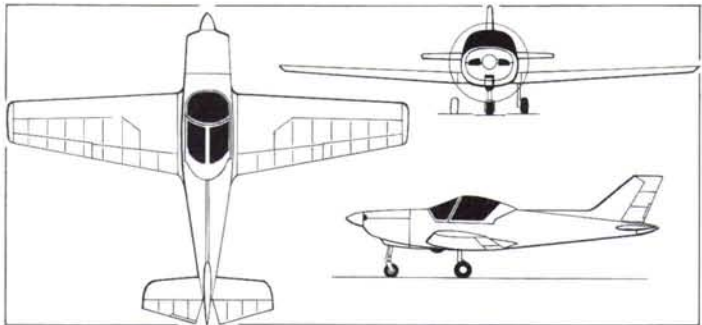
DIMENSIONS, EXTERNAL:	
Wing span	7.54 m (24 ft 8¾ in)
Length overall	6.15 m (20 ft 2 in)
Height overall	1.96 m (6 ft 5¼ in)
DIMENSIONS, INTERNAL:	
Cockpit max width	1.05 m (3 ft 5¼ in)



Alpi Pioneer 200 side-by-side kitbuilt

1159290

AREAS:	
Wings, gross	10.50 m ² (113.0 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	275 kg (606 lb)
Max T-O weight: Ultralight	450 kg (992 lb)
Experimental	520 kg (1,146 lb)
PERFORMANCE:	
Never-exceed speed (VNE)	129 kt (240 km/h; 149 mph)
Max operating speed	111 kt (205 km/h; 127 mph)
Normal cruising speed at 75% power	100 kt (185 km/h; 115 mph)
Stalling speed, flaps down	36 kt (65 km/h; 41 mph)
Max rate of climb at S/L	300 m (984 ft)/min
Service ceiling	5000 m (16,400 ft)
T-O and landing run	100 m (330 ft)
Range with max fuel	351 n miles (650 km; 403 miles)
with auxiliary fuel	448 n miles (830 km; 515 miles)
g limits	+4/-2



Alpi Pioneer 300 (James Goulding)

0137728

ALPI PIONEER 300

TYPE: Side-by-side kitbuilt.
PROGRAMME: First flight February 1999 (Italian ultralight category; Mid-West engine); public debut 2 April 1999 and exhibited at Aero '99, Friedrichshafen, later in the same month, at which time total of 11 hours flown. Certified to JAR-VLA standards.
CURRENT VERSIONS: **300L**: Long-span version for European market; no longer produced by Alpi.
300S: Short-span version, also known as **Standard**, predominantly for US market, as described.
300JS: Short-span, Jabiru engine.
300T: Short-span version with 84.5 kW (113.3 hp) Rotax 914.
300 Hawk: Short-span, rigid skin wing and redesigned cockpit interior.
330: Short-span, aerobatic version with inverted flight fuel system; g limits +6/-3. First known aircraft (I-7264) shown at Carpi Rally, 4 September 2004.

CUSTOMERS: At least 200 kits sold by early 2005; operated in Australia, Austria, Canada, France, Germany, Italy, Luxembourg, New Zealand, Portugal, Spain, Switzerland, the UK and the US.
COSTS: Kit EUR28,410; ready to fly with Rotax 912 ULS EUR67,220 (2006).
DESIGN FEATURES: Streamlined, retractable gear, low-wing monoplane, adaptable for Ultralight or Experimental category operation. Tapered wings and horizontal tail surfaces; sweptback fin; upturned wingtips; NACA 2315 aerofoil. Asso V has biconvex asymmetric wing section. Rearward-sliding canopy; fixed windscreen. Dual controls. Baggage shelf behind seats holds 27 kg (60 lb). Maximum roll rate 120°/s. Quoted build time 700 hours for standard kit; 350 hours for fast-build kit.
FLYING CONTROLS: Conventional and manual. Actuation by steel cables. Horn-balanced rudder. Electrically actuated flaps deflect 10, 20 and 30°. Trim tabs on rudder and port elevator.
STRUCTURE: Wooden airframe, including wing with single box spar; fuselage top and sides covered in carbon fibre shell, with Dacron covered undersides; latter replaced by removable carbon fibre shell on UK version. Integral fin with wooden spar and composites elsewhere;



Alpi Pioneer 300S

1159292

ailerons and flaps of wood with Dacron covering; tailplane wholly of composites; composites engine cowl and wingtips; Dacron-covered elevators and rudder; plywood-covered ailerons, flaps and tailplane.

LANDING GEAR: Retractable, tricycle type; steerable nosewheel with helical spring suspension. Mainwheels have levered oleo-pneumatic suspension (replacing rubber-in-compression in early aircraft). Mainwheels retract outwards; nosewheel rearwards; electric actuation with manual override. No doors, apart from fairing fixed ahead of nosewheel leg. Ingegno wheels with disc brakes; mainwheels size 4.00-6, nosewheel 4.00-4.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS four-stroke, driving a two-blade GT-2/173/155 fixed-pitch propeller. Three-blade and variable-pitch propellers optional. Alternative Jabiru 3300, Rotax 914 (84.5 kW; 113.3 hp), 59.7 kW (80 hp) Sauer and Mid-West AE110 engines. Fuel tank in each wing, combined capacity 80 litres (21.1 US gallons; 17.6 Imp gallons); 35 litre (9.2 US gallon; 7.7 Imp gallon) fuselage tank optional; 54 litre (14.3 US gallon; 11.9 Imp gallon) tank standard in US.

AVIONICS: To customer's choice.

DIMENSIONS, EXTERNAL:
Wing span: standard 8.10 m (26 ft 7 in)
short-span 7.54 m (24 ft 8 3/4 in)
Length overall 6.25 m (20 ft 6 in)

Height overall 2.00 m (6 ft 6 3/4 in)
DIMENSIONS, INTERNAL:
Cockpit max width 1.05 m (3 ft 5 1/4 in)
AREAS:
Wings, gross 10.00 m² (107.6 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 285 kg (628 lb)
Max T-O weight: ultralight 450 kg (992 lb)
standard 520 kg (1,146 lb)
experimental 544 kg (1,200 lb)
PERFORMANCE (Rotax 914 engine):
Never-exceed speed (VNE) and max level speed 160 kt (296 km/h; 184 mph)
Cruising speed at 75% power 135 kt (250 km/h; 155 mph)
Stalling speed 33 kt (60 km/h; 38 mph)
Max rate of climb at S/L 457 m (1,500 ft)/min
T-O and landing run 100 m (328 ft)
Range 540 n miles (1,000 km; 621 miles)
g limits +4/-2

AVIOTECHNICA

AVIOTECHNICA

via IV Novembre 65B, I-46040 Piubega

Tel/Fax: (+39 0376) 65 55 47

e-mail: info@aviotecnica.it

Web: www.aviotecnica.it

Formed in 1996, AvioTecnica originally marketed an Italian version of the RotorWay Exec two-seat kitbuilt helicopter under the designation ES-101 Exec, which it offered with a turbine engine in place of the original liquid-cooled piston engine. More recently, it has developed a further modified version known as the Raven.

AVIOTECHNICA ES-101 RAVEN

TYPE: Two-seat helicopter kitbuilt; two-seat ultralight helicopter kitbuilt.

PROGRAMME: Using a converted APU as power plant, AvioTecnica previously marketed the ES-101 Exec version of RotorWay Exec, the last of which was delivered in November 2003.

In 2004 it launched the ES-101 Raven, flying since at least 2001, which features several improvements. Demonstrator (6th airframe) shown at Aero '05, Friedrichshafen, in April 2005 with new, carbon fibre main rotor blades designed by AvioTecnica. Production aircraft (from No. 7) additionally have new swashplate, tail rotor blade, digital cockpit and transparencies attached by adhesives.

DESIGN FEATURES: Generally as for Exec 162F, produced in US by Rotorway International. External differences include two-piece windscreen and unstreamlined skid legs.

POWER PLANT: One 89.5 kW (120 hp) AvioTecnica-modified Solar T-61-A turboshaft with belt drive to main and tail rotors. Fuel capacity 90 litres (23.8 US gallons; 19.8 Imp gallons).

DIMENSIONS, EXTERNAL:
Main rotor diameter 7.62 m (25 ft 0 in)
Tail rotor diameter 1.28 m (4 ft 2 1/2 in)
Length overall, rotors turning 8.84 m (29 ft 0 in)
Fuselage max width over skids 1.60 m (5 ft 3 in)



AvioTecnica ES-101 Raven

1159279

Height overall 2.44 m (8 ft 0 in)
DIMENSIONS, INTERNAL:
Cabin max width 1.12 m (3 ft 8 in)
WEIGHTS AND LOADINGS:
Weight empty 275 kg (606 lb)
Max T-O weight: Ultralight 450 kg (992 lb)
Experimental 580 kg (1,278 lb)
PERFORMANCE:
Never-exceed speed (VNE) 129 kt (240 km/h; 149 mph)
Max level speed 119 kt (220 km/h; 137 mph)
Normal cruising speed 92 kt (170 km/h; 106 mph)
Max rate of climb at S/L 570 m (1,870 ft)/min
Service ceiling 5,500 m (18,040 ft)
Hovering ceiling: IGE 3,600 m (11,820 ft)
OGE 3,100 m (10,180 ft)

COAVIO

COAVIO COSTRUZIONI AERONAUTICHE

Via Morolense 64A, I-03013 Ferentino

Tel: (+39 0380) 297 94 87

e-mail: coavio@coavio.net

Web: www.coavio.net

TECHNICAL DIRECTOR: Antonio dell'Orco

COMMERCIAL DIRECTOR: Massimo Belloni

COAVIO DF 2000

TYPE: Side-by-side ultralight.

PROGRAMME: Promotion began in 2004. Production subcontracted to Officine Meccaniche Mingarelli at Ceccano.

CURRENT VERSIONS: **DF 2000 Base:** Baseline version with Rotax 912 UL engine.

DF 2000 Plus: Rotax 912 ULS engine.

DF 2000 Top: De luxe version, including three-blade propeller, cockpit heater, landing lights and radio as standard.



Production Coavio DF 2000 from the initial batch built by OMM (Geoffrey P Jones)

1044620

CUSTOMERS: First production batch of five built from 2004. Early operators include flying school, Aviosuperficie La Selva.

COSTS: DF 2000 EUR33,000; EUR2000 Plus EUR40,000; DF 2000 Top EUR44,000 (all excluding tax, 2004).

DESIGN FEATURES: Objectives included short take-off, high-speed and economic cruising, comfort, aesthetic appearance, robustness and low price. High, constant-chord wing with upturned tips and single bracing strut each side. Low tailplane; sweptback fin with small fillet.

FLYING CONTROLS: Conventional and manual. Electrically actuated flaps.

STRUCTURE: Generally of 2017T4 and 2024T3 aluminium, with chromoly 4139 steel tube reinforcement of cockpit. Composites wingtips.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring cantilever mainwheel legs with optional wheel fairings; steerable nosewheel.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS liquid-cooled flat-four driving a wooden two-blade or composites three-blade propeller. Optionally, one 59.6 kW (79.9 hp) Rotax 912 UL and two-blade wooden propeller. Two wing fuel tanks, combined usable capacity 70 litres (18.5 US gallons; 15.4 Imp gallons); optional additional central tank of 17 litres (4.5 US gallons; 3.7 Imp gallons).

DIMENSIONS, EXTERNAL:
Wing span 9.60 m (31 ft 6 in)
Length overall 6.35 m (20 ft 10 in)
Height overall 2.40 m (7 ft 10 1/2 in)
Wheel track 2.10 m (6 ft 10 3/4 in)
Wheelbase 1.50 m (4 ft 11 in)

DIMENSIONS, INTERNAL:
Cockpit max width 1.15 m (3 ft 9 1/4 in)

AREAS:
Wings, gross 11.52 m² (124.0 sq ft)

WEIGHTS AND LOADINGS:
Weight empty 275 kg (606 lb)
Max T-O weight 450 kg (992 lb)

PERFORMANCE:
Never-exceed speed (VNE) 129 kt (240 km/h; 149 mph)
Cruising speed at 75% power 105 kt (195 km/h; 121 mph)
Stalling speed, flaps down 22 kt (40 km/h; 25 mph)
T-O run 100 m (330 ft)
Landing run 80 m (265 ft)
g limits +6/-4

DFH

DF HELICOPTERS SRL

Via Priarona 82, I-15010 Cremolino-Ovada (AL)
 Tel: (+39 143) 83 57 68
 Fax: (+39 143) 865 55
 e-mail: contact@df-helicopters.net
 Web: www.df-helicopters.net
 MANAGING DIRECTOR: Adelbert Frommer
 PROJECT MANAGER: Guido Polidoro
 QUALITY MANAGER: Walter Myrzik
 MARKETING MANAGER: Milan Vuckovic

Original Dragon Fly company founded in 1993 by twin brothers Angelo and Alfredo Castiglioni specifically to produce the Dragon Fly 333 light helicopter, rights to which were taken over from general engineering company CRAE Elettromeccanica SpA. The company was taken over by German owners in 2001 and moved to a new 1,800 m² (19,375 sq ft) factory at Ovada. The Dragon Fly 333 has been further developed into the Dragon Fly 334 GP. Production for 2005 is set at 50.



DF Helicopters factory at Ovada

1159334

DFH DRAGON 334

TYPE: Two-seat helicopter.

PROGRAMME: Developed originally by CRAE; design studies and manufacture of single-seat prototype 1985-88; ground and flight testing of this aircraft, 1989-90; two-seat Model 333AC prototype built and tested, 1991-93. Total of two single-seat and three two-seat prototypes, followed by four pre-series aircraft; production, as Dragon Fly 333, transferred to new factory from October 1994. Developed and tested by manufacturer to standards approaching FAR Pt 27; initial Italian certification is in ultralight class, but domestic VLR (very light rotorcraft) certification obtained 16 June 1996. Relaunched at Aero '03, Friedrichshafen, April 2003, under new ownership and new designation.

In 2001, a Dragon Fly was flown at the Cielo di Volo air show, powered by a 112 kW (150 hp) APU of undisclosed type.

CURRENT VERSIONS: **Dragon Fly 333:** Original version; discontinued. Powered by one Dragon Fly/Hirth F30A26AK four-cylinder two-stroke, rated at 82 kW (110 hp) for T-O, 70.8 kW (95 hp) maximum continuous.

Dragon Fly 333AC: Certified version to Italian VLR rules. Discontinued.

Héliot: RPV version developed in association with French companies Etudes et Développement Techniques (EDT) and CAC Systèmes; launched in June 1996 when prototype displayed at Eurosatory 1996 show at Le Bourget, Paris. No further production known. Discontinued.

DFH X 334: Proof-of-concept vehicle for 334GP, with new engine, rotor controls and drive system. Flying by 2002.

Dragon 334 GP: Based on Dragon Fly 333 with commercial applications including traffic and border observation, aerial photography, powerline patrolling and crop-spraying. New rotor controls, drive system and tapered tail rotor blades, plus single-piece front/upper glazing. Prototype unfown by May 2003, when exhibited at Aero '03. As described.

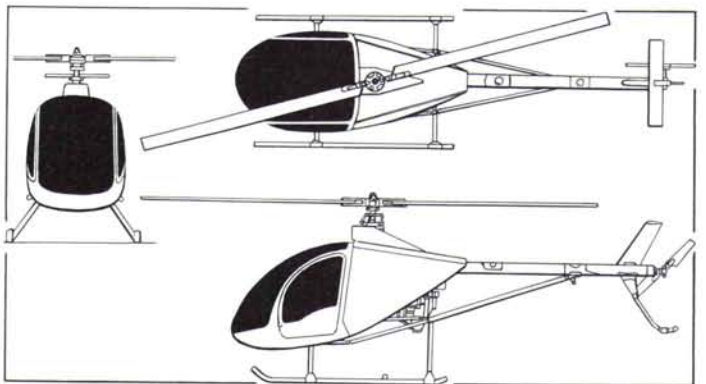
CUSTOMERS: First delivery of Dragon Fly in May 1994 to Chinese Civil Protection Volunteers. Total of 80 ordered, of which some 70 delivered, by late 1998 to customers in Abu Dhabi, Australia, Belgium, China, Czech Republic, France, Germany, Italy (37), New Zealand, Portugal and Turkey. First delivery of Italian certified version was in 1997; initial operator was Venice Aero Club. Dragon 334 deliveries had not begun by May 2004, although the company reported that 15 had been built. 2005 production set at 50 units, although no evidence of these having been built.

DESIGN FEATURES: Two-blade, semi-rigid main rotor and two-blade tail rotor; all blades of NACA 0012 aerofoil section; main rotor nominal speed 520 rpm. Can be road-towed on trailer with main blades folded. Optionally available in kit form.



DFH Dragon 334 (Paul Jackson)

1159359



DFH Dragon 334 (James Goulding)

0589011

STRUCTURE: Cabin is welded titanium frame with composites outer shell; aluminium alloy tailboom, rotor blades and landing skids. Full corrosion protection.

LANDING GEAR: Conventional twin-skid type. Emergency floats and skis under development.
 POWER PLANT: One 84.6 kW (113.4 hp) Rotax 914 flat-six derated to 77.6 kW (104 hp) at 5,500 rpm. Transmission driven through centrifugal clutch and three polymer V-belts. Fuel capacity 64 litres (16.9 US gallons; 14.1 Imp gallons) of which 57 litres (15.0 US gallons; 12.5 Imp gallons) are usable.

ACCOMMODATION: Side-by-side seats for two persons. Dual controls standard. Small baggage compartment below seats.

SYSTEMS: 12 V electrical system with engine-driven 75 Ah generator and 12 V 19 Ah battery.
 AVIONICS: *Comms:* Provision for transceiver and intercom.

Flight: Optional electric lateral trim.

Instrumentation: Standard VFR.

EQUIPMENT: Medevac and firefighting kits and external load hook under development.

DIMENSIONS, EXTERNAL:

Main rotor diameter	7.70 m (25 ft 3 3/4 in)
Tail rotor diameter	1.20 m (3 ft 11 1/4 in)
Length: overall, rotors turning	7.89 m (25 ft 10 1/2 in)
fuselage	5.86 m (19 ft 2 3/4 in)
Height to top of rotor head	2.36 m (7 ft 9 in)
Skid track	1.55 m (5 ft 1 in)

DIMENSIONS, INTERNAL:

Cabin: Length	1.11 m (3 ft 7 3/4 in)
Max width	1.15 m (3 ft 9 1/4 in)
Max height	1.13 m (3 ft 8 1/2 in)

AREAS:

Main rotor disc	35.21 m ² (379.0 sq ft)
Tail rotor disc	0.985 m ² (10.60 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	290 kg (639 lb)
T-O weight: normal	450 kg (992 lb)
max	550 kg (1,212 lb)

PERFORMANCE:

Never-exceed speed (VNE)	102 kt (190 km/h; 118 mph)
Max level speed at S/L	86 kt (160 km/h; 99 mph)
Max rate of climb at S/L	381 m (1,250 ft)/min
Service ceiling	3,050 m (10,000 ft)
Hovering ceiling: IGE	2,500 m (8,200 ft)
OGE	1,750 m (5,740 ft)
Range with 20 min reserves	216 n miles (400 km; 248 miles)
Endurance	3 h

PROGRAMME: Prototype (I-7698) first flew 2003. In production from 2006.

CURRENT VERSIONS: **VR 202 F 80:** Baseline version. Alpha series wing and ground-adjustable pitch propeller; Rotax 912 UL engine.

VR 202 FS 80: As F 80, but variable pitch propeller.

VR 202 F 100: Victor series wing and Rotax 912 ULS; ground-adjustable pitch propeller.

VR 202 FS 100: As F 100, but variable-pitch propeller.

COSTS: F 80 EUR39,860, FS 80 EUR49,690, F 100 EUR55,780, FS 100 EUR66,798 flyaway; kit EUR9,882 to EUR26,540, according to level of prior completion, plus EUR960 to EUR2,970 for Victor wing upgrade; LSA semi-complete kit EUR35,650 (all 2006).

DESIGN FEATURES: Streamlined design with low, trapezoidal wing having swept tips; low, trapezoidal tailplane and steeply sweptback fin.

Wing dihedral 5°; twist 2° 30'.

FLYING CONTROLS: Conventional and manual. Horn-balanced rudder. Flaps.

EG VOYAGER

EG VOYAGER

via Salussola 18, I-13900 Biella
 Tel: (+39 320) 113 32 26
 Fax: (+39 41) 546 04 58
 e-mail: egv@egvoyager.it
 Web: www.egvoyager.it

Series manufacture began in 2006 of the Voyager 202 Ultralight/Experimental two-seater.

EG VOYAGER VR 202

TYPE: Two-seat lightplane/kitbuilt; side-by-side ultralight/kitbuilt.



EG Voyager VR 202 FS 80 two-seat lightplane and kitbuilt (Andrea Pozza, EG Voyager)

1158847

STRUCTURE: Prototype of wood and fabric; production version generally with carbon fibre replacing fabric. Wing of spruce, with plywood lining and carbon fibre skin; Okumè plywood on Alpha series wing (450 kg; 992 lb MTOW) or aeronautical standard plywood on Victor wing (550 kg; 1,212 lb MTOW). Fuselage of carbon epoxy throughout; cockpit roll-bar.

LANDING GEAR: Tricycle type; fixed. Wing-mounted cantilever mainwheel legs with trailing-link shock absorbers; trailing-link nosewheel.

POWER PLANT: One Rotax flat-four driving a two-blade propeller: 58.8 kW (78.9 hp) 912 UL or 73.5 kW (98.6 hp) 912 ULS, according to version; ground-adjustable or variable-pitch propeller as version. Fuel tanks in wings, combined capacity 80 litres (21.1 US gallons; 17.6 Imp gallons) for 912 UL versions or 100 litres (26.4 US gallons; 22.0 Imp gallons) for 912 ULS versions; optionally 140 litres (37.0 US gallons; 30.8 Imp gallons).

ACCOMMODATION: Two persons, side by side under individual gull-wing doors; separate windscreen.

AVIONICS: Comms: Radio. Optional ELT.

Flight: GPS standard in F/FS 100 versions.

Instrumentation: Day VFR.

EQUIPMENT: Optional ballistic recovery parachute.

DIMENSIONS, EXTERNAL:	
Wing span	8.00 m (26 ft 3 in)
Wing aspect ratio	6.4
Length overall	6.40 m (21 ft 0 in)
Height overall	2.30 m (7 ft 6½ in)
Doors: Height	0.86 m (2 ft 9¾ in)
Max width	0.66 m (2 ft 2 in)
Wheel track	2.15 m (7 ft 0¾ in)
Wheelbase	1.49 m (4 ft 10¾ in)

DIMENSIONS, INTERNAL:	
Cockpit width: at shoulders	1.16 m (3 ft 9¾ in)
max	1.57 m (5 ft 1¾ in)
AREAS:	
Wings, gross	10.00 m² (107.6 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	278 kg (613 lb)
Max T-O weight: Ultralight	450 kg (992 lb)
Experimental/LSA	550 kg (1,212 lb)
Max wing loading: Ultralight	45.0 kg/m² (9.22 lb/sq ft)
Experimental/LSA	55.0 kg/m² (11.26 lb/sq ft)
Max power loading, Experimental/LSA	7.48 kg/kW (12.29 lb/hp)
PERFORMANCE (FS 80):	
Never-exceed speed (VNE):	
Alpha wing	145 kt (270 km/h; 167 mph)
Victor wing	156 kt (290 km/h; 180 mph)
Max level speed: Alpha wing	135 kt (250 km/h; 155 mph)
Victor wing	146 kt (270 km/h; 168 mph)
Cruising speed: max	124 kt (230 km/h; 143 mph)
econ	97 kt (180 km/h; 112 mph)
Stalling speed: flaps up	38 kt (70 km/h; 44 mph)
flaps down	33 kt (60 km/h; 38 mph)
Max rate of climb at S/L	200 m (660 ft)/min
T-O run	300 m (984 ft)
Range	648 n miles (1,200 km; 745 miles)
g limits: Alpha wing	+4.5/-2.5
Victor wing	+6/-3

EURO ALA

EURO ALA

Fraz S. Reparata, Zona Artigianale, I-64010 Civitella del Tronto (TE)
Tel: (+39 0861) 91 06 09
Fax: (+39 0861) 91 06 06
e-mail: info@euroala.it
Web: www.euroala.it
PRESIDENT: Alfredo Di Cesare

US SALES:
Euro ALA Advanced Light Aircraft Inc, 13 Crosley Lane, Suite 5, Sebring, Florida 33870
Tel: (+1 786) 417 89 60
e-mail: info@jetfoxusa.com
Web: www.jetfoxusa.com

The Advanced Light Aircraft (ALA) company was established in 1985, initially to import ultralights, but in 1991 began sales of its own Jet Fox 91. The company changed name to Euroala in 1995. In 2003, it revealed that it was working on an improved Jet Fox, due for completion at the end of the year. By 2005, a low-wing design was understood to be under consideration.

At the end of 2002, the company employed 15 workers at its 1,000 m² (10,764 sq ft) factory. Jet Fox is also marketed in US.



Euroala Jet Fox Amphib registered as a US Ultralight (Paul Jackson)

1159360

EUROALA JET FOX 97

TYPE: Side-by-side ultralight.

PROGRAMME: Earlier Jet Fox 91 first flown in 1991; 140 sold by 1993. Considerably improved Jet Fox 97 first flown 10 March 1997 and exhibited at Aero '97 at Friedrichshafen the following month. Jet Fox series certified in Germany 1993; France and Belgium in 1995 and Israel and Spain in 2001.

In January 2003 the company revealed that it was working on a new Jet Fox with wider cabin, new door opening system and aluminium wings with Fowler flaps, giving a cruise speed approaching 108 kt (200 km/h; 124 mph). Estimated first flight date given as end of 2003, but had not appeared by mid-2006.

An amphibian version (prototype A06AJB, c/n 061/05) made public debut at Sun 'n' Fun, April 2006.

CURRENT VERSIONS: **Jet Fox:** Baseline version; as described.

Jet Fox Amphib: Amphibian version introduced in United States. Powered by 73.5 kW (98.6 hp) Rotax 912 UL-S, maximum T-O weight 622 kg (1,373 lb).

Jet Fox GT: As Jet Fox, powered by Rotax 912 UL-S.

CUSTOMERS: Total of 61 built by the end of 2005, excluding remanufactured Jet Fox 91s.

COSTS: USD43,100 with Rotax 912UL; USD43,900 with Rotax 912UL-S (both 2003).

DESIGN FEATURES: Considerably refined version of earlier design, but bears structural resemblance to Fox-C22; fully faired fuselage and engine; flaps. Wings rapidly detachable for transport.

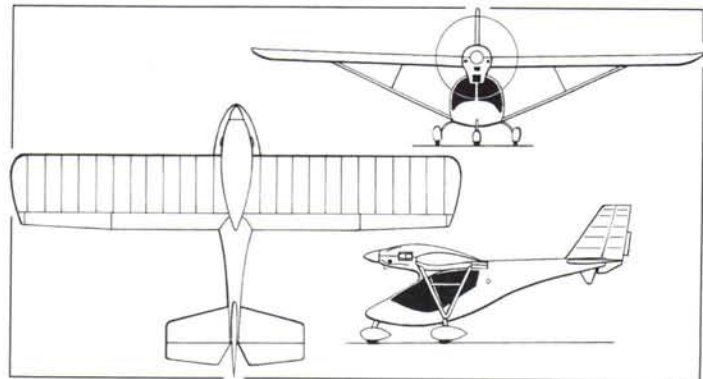
FLYING CONTROLS: Conventional and manual. Flight-adjustable elevator trim.

STRUCTURE: Alloy tube and steel fuselage frame with composites shell; Dacron-covered aluminium wings and tail surfaces; glass fibre and carbon fibre for landing gear.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted composites spring cantilever mainwheel legs. Mainwheels 4.00-6. Cable-operated disc brakes. Steerable nosewheel, size 4.00-4. Speed fairings optional. Optional amphibious floats.

POWER PLANT: One 47.8 kW (64.1 hp) Rotax 582 UL two-stroke or 59.6 kW (79.9 hp) Rotax 912 UL four-stroke engine, driving a two-blade GT wooden propeller; 73.5 kW (98.6 hp) Rotax 912 UL-S also available. Single fuel tank behind seats, capacity 59 litres (15.6 US gallons; 13.0 Imp gallons).

EQUIPMENT: Optional ballistic parachute.



General arrangement of the Euroala Jet Fox 97 (James Goulding)

1158756

EURO FLY

EURO FLY SRL

Via Ca'Onorai 50, I-35015 Galliera Veneta (PD)
Tel/Fax: (+39 049) 596 54 64
e-mail: gionnyulm@libero.it
Web: www.euroflyulm.com

Established in the early 1990s, Euro Fly markets a range of lightplanes and flexwing trikes including the Flash Light, Fire Fox, Fire Fox 2000 and Viper. Most recent of these is the FB5 Star Light.

EURO FLY FB5 STAR LIGHT



Manoeuvring a Euro Fly FB5 Star Light

1159282

DIMENSIONS, EXTERNAL:

Wing span	9.78 m (32 ft 1 in)
Length overall	5.78 m (18 ft 11½ in)
Height overall	2.80 m (9 ft 2¼ in)

AREAS:

Wings, gross	14.62 m ² (157.4 sq ft)
--------------	------------------------------------

WEIGHTS AND LOADINGS (Rotax 912):

Weight empty, incl parachute	290 kg (639 lb)
Max T-O weight	450 kg (992 lb)

PERFORMANCE (Rotax 912UL):

Max level speed	94 kt (175 km/h; 109 mph)
Cruising speed	81 kt (150 km/h; 93 mph)
Stalling speed	33 kt (60 km/h; 38 mph)
Max rate of climb at S/L	360 m (1,181 ft)/min
T-O run	100 m (330 ft)
Landing run	120 m (395 ft)
Endurance	4 h 30 min
g limits	+6/-3.5

TYPE: Side-by-side ultralight.

DESIGN FEATURES: Low, constant-chord wing; low tailplane with bracing strut below, each side. Large, sweptback fin.

FLYING CONTROLS: Conventional and manual. Flaps.

STRUCTURE: Metal tube structure; ALS 500 steel in cockpit area and 6082T6 alloy longerons; fabric covering.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring cantilever mainwheel legs and castoring nosewheel. Optional wheel fairings.

POWER PLANT: One Rotax, liquid-cooled, flat-four piston engine; option of 59.6 kW (79.9 hp) Rotax 912 UL or 73.5 kW (98.6 hp) Rotax 912 ULS. Fuel capacity 60 litres (15.9 US gallons; 13.2 Imp gallons).

DIMENSIONS, EXTERNAL:

Wing span	8.35 m (27 ft 4¾ in)
Length overall	6.60 m (21 ft 7¾ in)
Height overall	2.05 m (6 ft 8¾ in)

AREAS:

Wings, gross	11.48 m ² (123.6 sq ft)
--------------	------------------------------------

WEIGHTS AND LOADINGS:

Weight empty	282 kg (622 lb)
Max T-O weight	450 kg (992 lb)

PERFORMANCE:

Max level speed	121 kt (225 km/h; 140 mph)
Normal cruising speed	103 kt (190 km/h; 118 mph)
Stalling speed, flaps down	32 kt (58 km/h; 36 mph)
Max rate of climb at S/L	342 m (1,122 ft)/min
T-O run	95 m (315 ft)
Landing run	100 m (330 ft)
g limits	+6/-4

FLYITALIA

FLYITALIA SRL

Via Gorizia 1, I-96100 Siracusa
Tel: (+39 0335) 709 65 12
e-mail: commerciale@flyitalia.it
Web: www.flyitalia.it
COMMERCIAL DIRECTOR: Franco Buratto

OFFICE:

Aviosuperficie Dovera, Via Umberto I 51/1, I-26010 Dovera (CR)
Tel: (+39 0373) 97 80 08
Fax: (+39 0373) 945 71
e-mail: commerciale@flyitalia.it

Formed on 30 November 2002, FlyItalia has been local distributor for two types of ultralight built in the Slovak Republic: Aeropro Eurofox and Aerospool WT9 Dynamic.

In 2004, it launched a third product known as the MD3 Rider. The aircraft is produced by Gryf Aircraft (www.gryfair.cz) of the Czech Republic, a subsidiary of FlyItalia, originally formed in 1985 as a flying club within LET.

In late 2005, the company was working on a low-wing version of the Rider, using the designation MD4.

FLYITALIA MD3 RIDER

TYPE: Side-by-side ultralight kitbuilt.

PROGRAMME: Designed by Jaroslav Dostal, also responsible for the Interplane Skyboy.

Prototype (OK-JUR 06) first flew at Kunovice, Czech Republic, 25 February 2004. First production (OK-JUR 17) flew 7 August 2004 and delivered to Sigi Salomoni and Salgaro of *Take-Off Magazine*; No. 003 for static tests. Czech certification awarded 31 May 2006. Tests of Rider (OK-KUU 71, c/n 031) powered by 73.5 kW (98.6 hp) Rotax 912S completed June 2006. Production due to move to Pribam, also in Czech Republic, in late 2006.

CURRENT VERSIONS: **Sporty:** Baseline version, aimed at general aviation and flight training markets. *Data refers to this version unless otherwise stated.*

UL: Lower-powered version, with 59.6 kW (79.9 hp) Rotax 912UL engine. Empty weight 275 kg (606 lb); max T-O weight 450 kg (992 lb).

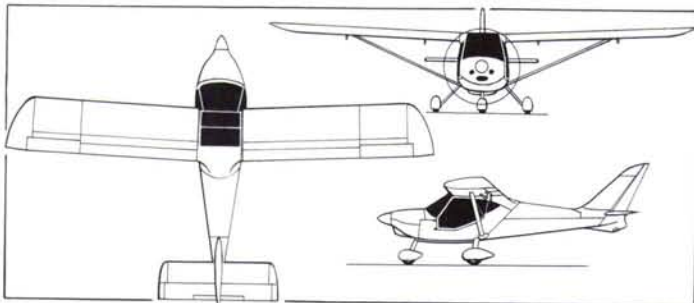
CUSTOMERS: Total 31 built by June 2006 for customers in France, Italy, Slovak Republic and US.

DESIGN FEATURES: Designed to meet certification requirements throughout Europe. High-mounted, strut-braced wing of constant chord; sweptback fin with characteristic Gryf design curved tip; small underfin; constant-chord tailplane. Wings have MS(1)-0313 aerofoil and 3° forward sweep. Wings fold and tail surfaces are removable for transportation and storage. Symmetrical NACA 12% profile tailplane.



First FlyItalia MD3 Rider to be powered by Rotax 912S flat-four (Petr Šterba)

1159284



FlyItalia MD3 Rider (James Goulding)

1127532

FLYING CONTROLS: Conventional and manual. Cable-operated rudder; rod-operated single-piece elevator and ailerons. Electrically operated four-position (0, 15, 30, 42°) flaps cover 60 per cent of wing span. Electrically controlled trim tab on elevator centreline.

STRUCTURE: All-metal semi-monocoque airframe and integral empennage with composite-skinned welded steel tube fuselage cockpit cage and composites engine cowlings.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, cantilever spring composites mainwheel legs and steerable nosewheel leg, latter with steel tube fork and rubber shock absorption. Hydraulic disc brakes on mainwheels. All wheels 16x4 in.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 UL flat-four driving a three-blade, ground-adjustable pitch Woodcomp SR-200B propeller, diameter 1.68 m (5 ft 6¼ in). Fuel capacity 72 litres (19.0 US gallons; 15.8 Imp gallons) of which 70 litres (18.5 US gallons; 15.4 Imp gallons) are usable; optionally 100 litres (26.4 US gallons; 22.0 Imp gallons).

EQUIPMENT: Optional ballistic parachute.

DIMENSIONS, EXTERNAL:

Wing span	8.50 m (27 ft 10½ in)
Length overall	5.70 m (18 ft 8½ in)
Height overall	2.30 m (7 ft 6½ in)
Propeller diameter	1.63 m (5 ft 4¼ in)

DIMENSIONS, INTERNAL:

Cockpit max width	1.16 m (3 ft 9½ in)
-------------------	---------------------

AREAS:

Wings, gross	9.50 m² (102.3 sq ft)
--------------	-----------------------

WEIGHTS AND LOADINGS:

Weight empty	297 kg (655 lb)
Max baggage weight	15 kg (33 lb)
Max T-O weight	480 kg (1,058 lb)

PERFORMANCE:

Never-exceed speed (VNE)	145 kt (270 km/h; 167 mph)
Max operating speed	119 kt (220 km/h; 137 mph)
Stalling speed, flaps down	33 kt (60 km/h; 38 mph)
Max rate of climb at S/L	420 m (1,378 ft)/min
Range with max fuel	540 n miles (1,000 km; 621 miles)

FLY LINE

FLY LINE SRL

Via del Commercio 16, I-33050 Torviscosa (UD)

Tel/Fax: (+39 0431) 92 90 31

e-mail: info@flylineaviation.com

Web: www.flylinesrl.it

DIRECTOR: Giuseppe Milito

FLY SYNTHESIS

FLY SYNTHESIS SRL

Via Gorizia 63, I-33050 Gornars (UD)

Tel: (+39 0432) 99 24 82 and 99 35 57

Fax: (+39 0432) 93 12 80

e-mail: info@flysynthesis.com

Web: www.flysynthesis.com

OWNER AND DIRECTOR: Sonia Felice

PRODUCTION DIRECTOR: Rodolfo Ciotti

TECHNICAL, RESEARCH AND DEVELOPMENT DIRECTOR: Corrado Pinzana

The Storch ultralight produced by this company also provides the basis of the tailwheel/T tail Pipistrel Sinus motor glider and ultralight, built in Slovenia. US marketing undertaken by American Ghiles Aircraft.

At the end of 2004, FlySynthesis employed 16 in its 1,100 m² (11,850 sq ft) factory.

FLY SYNTHESIS STORCH

US Name: Lafayette Stork

TYPE: Side-by-side ultralight/kitbuilt.

PROGRAMME: First flown in 1991 and initially marketed as Rodaro Storch. Certified in Austria, Belgium, France, Germany, Greece, Hungary, Israel, Italy, Malaysia, Slovenia and the USA.

CURRENT VERSIONS: **Classic**: Standard version, as described.

Super Speed: As Classic but with shorter overall length (5.95 m; 19 ft 6¼ in) and wing span (9.32 m; 30 ft 7 in) and Rotax 912 UL or Jabiru 2200 engine. Flaps. Not available in kit form.

High Speed: As Super Speed, but with shorter overall length (5.75 m; 18 ft 10¾ in) and (8.71 m; 28 ft 7 in) wing span.

CUSTOMERS: 350 built by end of 2004. Recent sales to customers in South Korea and Congo-Brazzaville.

COSTS: Ready-to-fly: Classic, High Speed: (Rotax 582) EUR34,000, (Jabiru) EUR38,000; S: EUR40,000; kit: Classic, High Speed EUR20,500 (all 2005).

DESIGN FEATURES: Laminar flow aerofoil section. Strut-braced wings fold alongside fuselage for storage. Quoted build time 180 hours.

FLYING CONTROLS: Manual. Cable operated rudder and elevator; rod-operated ailerons. Full-span, Junkers-type slotted ailerons and all-moving tailplane with anti-balance tab.

STRUCTURE: Composites main fuselage shell with welded steel tube frame in cabin area and tubular alloy tailboom; light alloy constant chord wing has 6082 light alloy spar and composites skin; all-composites wing optional.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring alloy tube mainwheel legs with wheel fairings. Mainwheels 4.00-6, nosewheel 4.00-4. Drum brakes on Classic and High Speed, disc brakes on Super Speed and, optionally, High Speed. Oil-damped, steerable nosewheel with maximum deflection ±40°. Optional floats.

POWER PLANT: Classic and High Speed have one 47.8 kW (64.1 hp) Rotax 582 UL or 59.7 kW (80 hp) Jabiru 2200; Super Speed has one 59.6 kW (79.9 hp) Rotax 912 UL or 59.7 kW (80 hp) Jabiru 2200, each driving a two-blade wood or composites, or three-blade composites propeller. Standard fuel capacity 60 litres (15.9 US gallons; 13.2 Imp gallons), of which 56 litres (14.8 US gallons; 12.3 Imp gallons) are usable.

ACCOMMODATION: Cabin doors open upwards.

EQUIPMENT: BRS ballistic recovery parachute optional.

Data below refer to Classic with Jabiru 2200 engine, except where stated.

DIMENSIONS, EXTERNAL:

Wing span: Classic	10.14 m (33 ft 3¼ in)
High Speed	8.71 m (28 ft 7 in)
Super Speed	9.32 m (30 ft 7 in)
Length overall	6.25 m (20 ft 6 in)
Height overall: landplane	2.45 m (8 ft 0½ in)
amphibian	3.15 m (10 ft 4 in)

AREAS:

Wings, gross: Classic	13.50 m² (145.3 sq ft)
High Speed	11.60 m² (124.9 sq ft)
Super Speed	10.20 m² (109.8 sq ft)

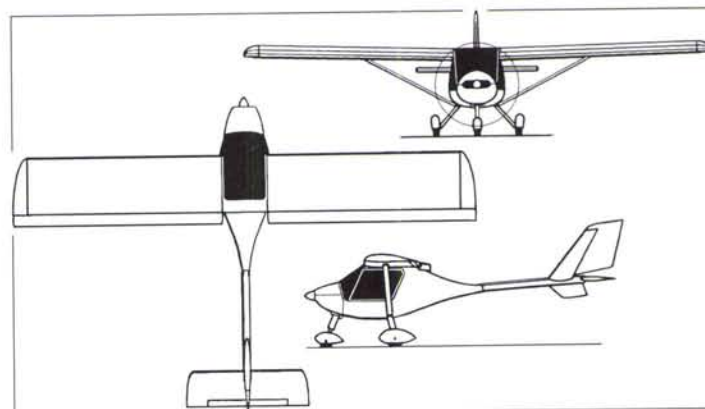
WEIGHTS AND LOADINGS:

Weight empty: Classic	270 kg (595 lb)
High Speed	262 kg (578 lb)
Super Speed	275 kg (606 lb)
Max T-O weight	450 kg (992 lb)



Fly Synthesis Storch HS (High Speed) (Paul Jackson)

1159361



Jabiru-engined Storch High Speed (Paul Jackson)

0546948

PERFORMANCE:

Never-exceed speed (VNE): Classic	97 kt (180 km/h; 112 mph)
High Speed, Super Speed	129 kt (240 km/h; 149 mph)
Cruising speed at 75% power: Classic	84 kt (155 km/h; 96 mph)
High Speed	90 kt (165 km/h; 103 mph)
Super Speed	103 kt (190 km/h; 118 mph)
Stalling speed	31 kt (57 km/h; 35 mph)
High Speed, Super Speed	36 kt (65 km/h; 41 mph)
Max rate of climb at S/L:	
Classic	300 m (984 ft)/min
High Speed	270 m (886 ft)/min
Super Speed	240 m (787 ft)/min
T-O run: Classic	88 m (289 ft)
High Speed	90 m (295 ft)
Super Speed	130 m (427 ft)
Landing run: Classic	115 m (377 ft)
High Speed	130 m (427 ft)
Super Speed	140 m (460 ft)
Range: Classic	356 n miles (659 km; 410 miles)
Endurance	3 h 18 min
g limits	+4/-2

FLY SYNTHESIS TEXAN

TYPE: Side-by-side ultralight.

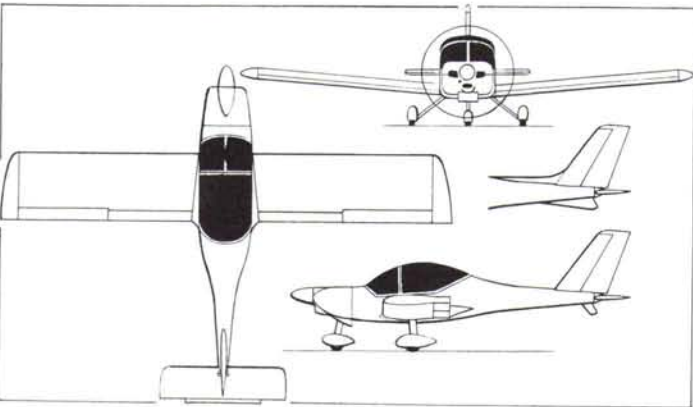
PROGRAMME: First flown 1999. Available factory-built only.

CURRENT VERSIONS: **Texan Top Class**: Standard version, as described.

Texan RG: Launched at Aero'03 Friedrichshafen where shown statically and first flown May 2003; electrically operated retractable landing gear; mainwheels retract outward and nosewheel rearward; manual emergency operation. Dimensions as standard Texan, but increased vertical area at empennage provided by fin fillet and ventral strake. Empty weight 285 kg (628 lb); stalling speed 34 kt (62 km/h; 39 mph); never-exceed speed 151 kt (280 km/h; 174 mph).



Fly Synthesis Texan (Paul Jackson) 1159362



Fly Synthesis Texan two-seat ultralight, with scrap view of Texan RG empennage (James Goulding) 1159391

Texan Solaris: Special edition version of Texan RG with 84.6 kW (113.4 hp) Rotax 914 driving variable-pitch Idrovario propeller. Features leather seating and improved instrumentation.

CUSTOMERS: More than 60 built by January 2006, including several to Israel. Certified in Australia, Belgium, France, Israel, Italy and Portugal.

COSTS: Kit EUR35,000. Ready to fly EUR54,500 (Jabiru): EUR56,500 (Rotax 912) (all 2005).

DESIGN FEATURES: Low-wing monoplane. Constant-chord wing of laminar flow aerofoil section; sweptback fin and rudder; rearward-sliding cockpit canopy with fixed windscreen. Quoted build time 280 hours.

FLYING CONTROLS: Manual. Rudder and elevator are cable-operated; ailerons are rod-operated. Ground-adjustable trim tab on starboard aileron; all-moving tailplane with anti-balance tab and mass balance weights; horn-balanced rudder. Four-position slotted flaps, maximum droop 45°.

STRUCTURE: Carbon fibre fuselage with Nomex sandwiched carbon fibre wings, tailplane and control surfaces.

LANDING GEAR: Tricycle type; fixed (except RG version). Fuselage-mounted spring cantilever mainwheel legs with wheel fairings. Mainwheels 4.00–6, nosewheel 4.00–4; streamlined fairings on all three wheels. Hydraulic disc brakes on mainwheels.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS driving a two-blade GT-2/173/155 wooden or three-blade Pipistrel PBM300 BAM3D 165 composites propeller; propellers by DUC, Avtek and Quinti Avio can also be fitted. Fuel in wingroot tanks, total capacity 72 litres (19.0 US gallons; 15.8 Imp gallons), of which 68 litres (18.0 US gallons; 15.0 Imp gallons) usable.

ACCOMMODATION: All aircraft have provision for rapid conversion for disabled pilots.

EQUIPMENT: BRS ballistic recovery parachute system optional.

Data below refer to Texan Top Class unless otherwise indicated.

DIMENSIONS, EXTERNAL:	
Wing span: both	8.60 m (28 ft 2½ in)
Length overall: both	6.92 m (22 ft 8½ in)
Height overall: both	2.61 m (8 ft 6¾ in)
AREAS:	
Wings, gross: both	12.04 m ² (129.6 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty: both	290 kg (639 lb)
Max T-O weight: both	450 kg (992 lb)
PERFORMANCE (Rotax 912 ULS):	
Never-exceed speed (VNE): Texan Top Class	129 kt (240 km/h; 149 mph)
Texan RG	151 kt (280 km/h; 174 mph)
Cruising speed at 75% power: Texan Top Class	103 kt (190 km/h; 118 mph)
Texan RG	124 kt (230 km/h; 143 mph)
Stalling speed: both	36 kt (65 km/h; 41 mph)
Max rate of climb at S/L: Texan Top Class	360 m (1,181 ft)/min
Texan RG	480 m (1,575 ft)/min
T-O run: Texan Top Class	155 m (508 ft)
Landing run: Texan Top Class	140 m (460 ft)

FLY SYNTHESIS NEW WALLABY

TYPE: Side-by-side ultralight kitbuilt.

PROGRAMME: First flight took place in 1999. Certified in Belgium, France and Italy.

CURRENT VERSIONS: **Wallaby:** Original single-seat version; now superseded.

New Wallaby: Two-seat version introduced by 2004.

CUSTOMERS: More than 23 of all versions built by end of 2005.

COSTS: Kit EUR11,200, ready-to-fly EUR20,300 (2005).

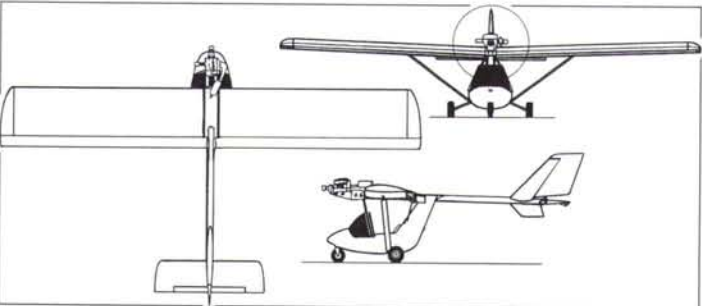
DESIGN FEATURES: Strut-braced high-wing monoplane. Pod-and-boom fuselage. Wings fold for storage/transport. Open cockpit with windscreen; optional 'winter canopy'. Sweptback fin. Quoted build time 150 hours.

FLYING CONTROLS: Manual. All-moving tailplane with anti-balance tab and mass balance weights.

STRUCTURE: Utilises Storch wing and tail unit, but in composites and with reprofiled ventral fin. Glass fibre fuselage pod.



Single-seat Fly Synthesis Wallaby (Paul Jackson) 1159363



General arrangement of Fly Synthesis Wallaby (Paul Jackson) 0546957

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring metal tube cantilever mainwheel legs. Mainwheel size 14x4. Drum brakes on mainwheels.

POWER PLANT: One 37.0 kW (49.6 hp) Rotax 503 UL driving a two-blade GT-2/170/90 wooden propeller. Fuel capacity 60 litres (15.9 US gallons; 13.2 Imp gallons) in wingroot tanks.

ACCOMMODATION: Open, but 'winter canopy' available, as extra, to enclose occupants.

DIMENSIONS, EXTERNAL:

Wing span	10.14 m (33 ft 3¼ in)
Length overall	5.75 m (18 ft 10½ in)
Height overall	2.41 m (7 ft 10¾ in)

AREAS:

Wings, gross	13.50 m ² (145.3 sq ft)
--------------------	------------------------------------

WEIGHTS AND LOADINGS:

Weight empty	236 kg (520 lb)
Max T-O weight	425 kg (937 lb)

PERFORMANCE:

Never-exceed speed (VNE)	81 kt (150 km/h; 93 mph)
Cruising speed at 75% power	64 kt (118 km/h; 73 mph)
Stalling speed	27 kt (50 km/h; 32 mph)
Max rate of climb at S/L	150 m (492 ft)/min
T-O run	60 m (197 ft)
Landing run	75 m (246 ft)
g limits	+4/-2

FLY SYNTHESIS MANTHOS

TYPE: Side-by-side ultralight.

PROGRAMME: Announced at Aero '05, Friedrichshafen, in April 2005 when second of two scale, aerodynamic proving, flying models was shown. First flight of prototype then planned in 2007; prototype development was continuing during 2006.

DESIGN FEATURES: New concept for ultralight aircraft, based on lifting fuselage with pressure recovery. Trapezoidal wing; twin fins with rudders; winglets.

FLYING CONTROLS: Manual. Differential ailerons; slotted flaps.

STRUCTURE: Composites throughout.

LANDING GEAR: Tricycle type; retractable.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS flat-four. Fuel capacity 150 litres (39.6 US gallons; 33.0 Imp gallons).



Experimental flying scale model of proposed Fly Synthesis Manthos two-seat ultralight (Paul Jackson) 1127745

DIMENSIONS, EXTERNAL:	
Wing span	8.60 m (28 ft 2½ in)
Length overall	5.90 m (19 ft 4¼ in)
Height overall	2.15 m (7 ft 0¾ in)
AREAS:	
Wings, gross	13.10 m² (141.0 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	260 kg (573 lb)
Max T-O weight	450 kg (992 lb)

FRATI

STELIO FRATI

Via Noe 1, I-20100 Milano
 Tel/Fax: (+39 02) 204 78 31
 CHIEF DESIGNER: Dott Ing Stelio Frati

In 1998, Dott Ing Frati left General Avia to resume the activities of a freelance designer - a career successfully practised since 1950. His past designs include the F.4 and F.7 Rondone, F.8

PERFORMANCE:	
Never-exceed speed (VNE)	178 kt (330 km/h; 205 mph)
Cruising speed at 75% power	151 kt (280 km/h; 174 mph)
Stalling speed: flaps up	33 kt (60 km/h; 38 mph)
flaps down	26 kt (48 km/h; 30 mph)
T-O run	110 m (360 ft)
Landing run	120 m (395 ft)

Falco, F.14 Nibbio, F.15 Picchio, F.250 (now manufactured by Aermacchi as the SF-260), SF.600A Canguro (for SIAI-Marchetti, and now VulcanAir), F.20 Pegaso, and the F.22 Pinguino. The F.8 Falco is marketed as a kit aircraft by Sequoia Aircraft Corporation of the USA.

Frati has designed a new four-seat, all-composites tourer with a 194 kW (260 hp) engine for III of Italy and the similar F28 for ICP; continuing projects are the F.1000 light jet and the F.2500 twin-turboprop, described in previous editions of *Jane's All the World's Aircraft*.

HELISPORT

CH-7 HELISPORT SRL

Strada Trafor del Pino 102, I-10132 Torino
 Tel: (+39 011) 899 67 30
 Fax: (+39 011) 899 55 50
 e-mail: kompress@tin.it
 Web: www.ch-7helicopter.com

Previously known as EliSport, the company markets the Kompress, a development by Josi and Claudio Barbero of the CH-6 open frame helicopter produced in 1987 by the Argentine designer Augusto Cicaré. US agent is Lancair.

HELISPORT CH-7 KOMPRESS

TYPE: Two-seat ultralight helicopter kitbuilt.
 PROGRAMME: CH-6 project acquired in 1989 by HeliSport; added new cockpit by sports car designer Marcello Gandini; renamed CH-7 Angel, two-seat version became Kompress.
 CURRENT VERSIONS: **CH-7 Kompress:** Standard version, replaced by Kompress Charlie.
CH-7 Kompress Charlie: Developed in 2005 from earlier Kompress, as described. Earlier versions can be upgraded to this standard.
CH-7 Mariner: Float-equipped version. Multi-tube inflatable floats add 15 kg (33 lb) to empty weight.



HeliSport CH-7 Kompress (Paul Jackson)

1159364

ICP

ICP SRL

Via Torino 12, Piovà Massaia (At)
 Tel: (+39 0141) 99 65 03
 Fax: (+39 0141) 99 65 06
 e-mail: info@icp.it
 Web: www.icp.it
 PRESIDENT: Tancredi Razzano
 TECHNICAL MANAGER: Stefano Agostinetto
 QUALITY MANAGER: Renato Pescamona

The company was founded in 1991 and markets aircraft strongly resembling Zenair designs from the USA. It is also active in the automotive industry. Factory floor area 3,000 m² (32,300 sq ft); workforce 40 in January 2003. Production of the Amigo (Zenith Zodiac) has ended.

ICP MXP-740 SAVANNAH

TYPE: Side-by-side ultralight.
 PROGRAMME: Strongly resembles Zenith CH 701, except for conventional rudder and elevators; see Ekoflug MXP-740 (Slovak Republic) for description. Version with amphibious floats is designated **Savannah Hydro**; with Rotax 503 engine is **Bingo 503**; with Simonini Victor 2 engine (first flown 19 October 2001) is **Super Bingo**; with HKS

PERFORMANCE:	
Never-exceed speed (VNE)	112 kt (209 km/h; 129 mph)
Max cruising speed:	86 kt (160 km/h; 99 mph)
Max rate of climb at S/L: Europe	450 m (1,476 ft)/min
USA	347 m (1,140 ft)/min
Hovering ceiling: IGE	3,500 m (11,480 ft)
OGE	2,500 m (8,200 ft)
Service ceiling	5,000 m (16,400 ft)
Range: with normal fuel	259 n miles (480 km; 298 miles)
with optional fuel	388 n miles (719 km; 477 miles)
Endurance:	3 h 0 min

DIMENSIONS, EXTERNAL:	
Main rotor diameter	6.27 m (20 ft 6¾ in)
Tail rotor diameter	1.03 m (3 ft 4½ in)
Length: fuselage	5.31 m (17 ft 5 in)
overall, rotors turning	7.41 m (24 ft 4 in)
Fuselage max width	0.82 m (2 ft 8¼ in)
Height to top of rotor head	2.31 m (7 ft 7 in)
Skid track	1.50 m (4 ft 11 in)
DIMENSIONS, INTERNAL:	
Cabin max width	0.76 m (2 ft 6 in)
AREAS:	
Main rotor disc	29.90 m² (321.8 sq ft)
Tail rotor disc	0.83 m² (8.93 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty: Europe	275 kg (606 lb)
USA	281 kg (620 lb)
Max T-O weight: Europe	450 kg (992 lb)
USA	499 kg (1,100 lb)



ICP Savannah registered in Ireland (Paul Jackson)

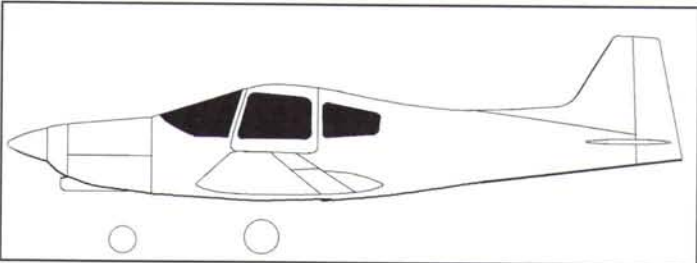
1037926

700E is **Bingo 4T** (2003). ICP offers a retrofit tapered wing (span 8.00 m; 26 ft 3 in, area 9.40 m²; 101.2 sq ft, root chord 1.50 m; 4 ft 11 in, tip chord 0.75 m; 2 ft 5½ in) to produce the **Savannah Advanced**. Savannah is certified for operation as an ultralight in Belgium, France, Germany, Israel, Italy, Luxembourg, Netherlands, Norway and Slovak Republic. Some 420 built by early 2006 (including Bingo).
COSTS: GBP13,500 less engine, or GBP21,650 with Jabiru 2200 engine, including UK VAT (2006).



Prototype ICP Vimana two-seat LSA

1158995



Profile of ICP F28 (Paul Jackson)

0576218

ICP SA2 VIMANA

North American marketing name: Rampage

TYPE: Two-seat lightplane.

PROGRAMME: First details released in 2003. Prototype (I-8439) completed in May 2006. Public debut at Cielo e Volo air show, Ozzano, 10-11 June 2006. Marketed in North America (US LSA category) under name of Rampage by Skykits of Alberta, Canada.
Vimana is the ancient Sanskrit word for a flying machine.

COSTS: CAD89,995 flyaway (2007).

DESIGN FEATURES: Optimised for STOL performance. High wing of trapezoidal planform; single bracing strut and auxiliary strut each side. Sweptback fin with fillet; low tailplane; large rudder and elevators. Optional lightened version has smaller wheels, lighter upholstery and instruments and other weight savings.

Wing section NACA 23015.

FLYING CONTROLS: Conventional and manual. Horn-balanced elevators; full-height rudder. Double-slotted flaps; electrically operated (manual back-up) leading-edge slat.

STRUCTURE: Generally of riveted aluminium.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, spring cantilever mainwheel legs. Steerable nosewheel. Fairings on all wheels.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS flat-four driving a KievProp three-blade, ground-adjustable pitch, composites propeller.

ACCOMMODATION: Two persons, side by side. Fully-glazed door each side.

DIMENSIONS, EXTERNAL:

Wing span 8.00 m (26 ft 3 in)
Wing chord: at root 1.50 m (4 ft 11 in)
 at tip 0.75 m (2 ft 5½ in)
Wing aspect ratio 6.8

AREAS:

Wings, gross 9.40 m² (101.2 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: normal 300-330 kg (661-728 lb)
 optional 286 kg (631 lb)
Max T-O weight 560 kg (1,234 lb)
Max wing loading 59.6 kg/m² (12.20 lb/sq ft)
Max power loading 7.62 kg/kW (12.52 lb/hp)

PERFORMANCE (estimated):

Max level speed 129 kt (240 km/h; 149 mph)
Normal cruising speed 108 kt (200 km/h; 124 mph)
Stalling speed, flaps down 27 kt (50 km/h; 31 mph)
Max rate of climb at S/L 366 m (1,200 ft)/min
T-O run 35 m (115 ft)
g limits +6/-3

ICP F28

ICP has commissioned the design of a four-seat light aircraft from Stelio Frati. No details of timescale have been announced.

The machine is of typical Frati appearance, with low, tapered wings, centre-hinged cabin doors and retractable tricycle landing gear.

Leading particulars include span of 8.80 m (28 ft 10½ in); length 6.80 m (22 ft 3¼ in); max level speed 184 kt (340 km/h; 211 mph); cruising speed 167 kt (310 km/h; 193 mph).

III

INIZIATIVE INDUSTRIALI ITALIANE SPA

Viale Gorizia 6, I-00198 Roma
Tel: (+39 06) 854 63 41
Fax: (+39 06) 85 30 14 61
e-mail: treidirgen@skyarrow.com
Web: www.skyarrow.com
DIRECTOR: Luciana Bartolotti-Lauri

PRODUCTION PLANT:

Via Leonardo da Vinci 19/23, I-00016
Monterotondo Scalo, Roma
Tel: (+39 06) 90 08 55 45
Fax: (+39 06) 90 08 55 45
e-mail: kteam@skyarrow.com

US AGENT:

Pacific Aerosystem Inc
5760 Chesapeake Court, San Diego, California 92123, USA
Tel: (+1 858) 571 14 41
Fax: (+1 858) 571 08 03
e-mail: info@skyarrowusa.com
Web: www.skyarrowusa.com
PRESIDENT: Edward V Dempsey Jr

Company formed April 1947 in Trieste, as Meteor SpA. Main R&D and production facility

then in Monfalcone, where two- and four-seat aircraft produced for training and sport flying, plus target aircraft and electronic systems for military market. Present company created in 1985; relocated to new facility in Monterotondo 1989; now produces general aviation aircraft and platforms based on the Sky Arrow for aerial surveillance and environmental monitoring. Plans to market a range of low-wing lightplanes have been delayed.

III SKY ARROW

TYPE: Two-seat lightplane; tandem-seat ultralight.
PROGRAMME: First flight March 1993; certified by FAA to FAR Pt 23 and by ENAC (Italy) to JAR-VLA, primary aircraft sport category.
CURRENT VERSIONS: Designations refer to maximum T-O weights in kilograms.



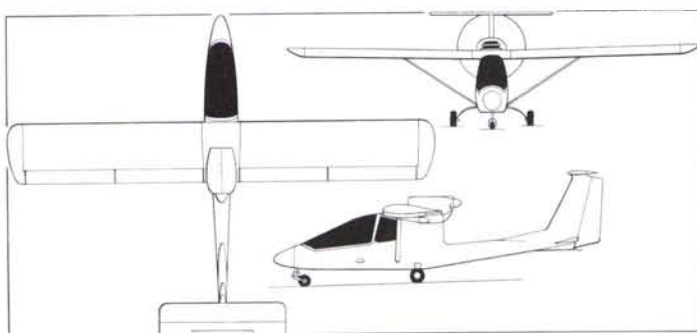
III Sky Arrow 650T amateur-built in UK (Paul Jackson)

1159078



First Ill Sky Arrow 600 Sport, marketed in US Light Sport Aircraft category (Paul Jackson)

1159079



Ill Sky Arrow 650 very light aircraft (James Goulding)

0011089

450TS and 450TGS: For markets where MTOW for ultralights is 450 kg (including Czech Republic, Germany, Greece, Netherlands and Norway), TGS is German version.

480TS: For markets (including Australia, Canada and New Zealand) where MTOW for ultralights is 480 kg.

500TF: For markets (including France) where MTOW for ultralights is 500 kg.

600 Sport: Approved as Light Sport Aircraft for US market on 4 November 2005, following delivery of US prototype (N389SA) shortly before, MTOW 599 kg (1,320 lb).

650TCS: JAR-VLA and FAR Pt 23 certified for day or night VFR, MTOW 650 kg.

650TCNS: JAR-VLA and FAR Pt 23 certified for day or night VFR operation, FAA certificate awarded 3 March 2003, MTOW 650 kg. Total 29 built by mid 2004, including first eight as TCN. Retractable gear prototype (I-RGSA) flown mid-2004.

Description below applies to these versions, except where noted.

650 TCNS ERA: Environmental Research Aircraft variant equipped with surface surveillance sensors provided by the US National Oceanic Atmospheric Administration. Features fully retractable nosewheel and folding main landing gear.

650 TCNS RAWAS: Remotely Assisted Working Aerial System. Mission equipment can include gyro-stabilised and traversable video cameras, FLIR, IR linescan, vertical multispectral sensor, crop growth monitoring sensors, magnetometer or vertical panoramic still camera; operates as airborne relay station for RAWAS surveillance system, receiving and transmitting data via digital link at range up to 65 n miles (120 km; 75 miles) from fixed or mobile ground stations. Fully retractable nosewheel and folding main landing gear.

RFG: 'Retractable Fixed Gear'. One aircraft (I-RAWF), demonstrated 2001: proof-of-concept for ERA and RAWAS versions, providing clear field of view for ventral sensors. Nosewheel retracts conventionally; regular Sky Arrow mainwheel legs splay outwards and upwards.

710RG: 'Complex aircraft', certified to JAR-VLA for day and night VFR operation and intended for use as an advanced trainer, MTOW 710 kg (1,565 lb). Retractable landing gear.

Twin Arrow: Twin fuselage, four-seat (two-pilot), STOL, amphibious variant, under development in 2006 for long endurance public security surveillance and environment monitoring missions. Two fuselages and outer wings linked by new wing centre-section. Avionics and instrumentation include differential GPS, laser altimeter, digital map display and night flying equipment. Maximum take-off weight 1,230 kg (2,711 lb).

CUSTOMERS: Some 250 built by 2004.

DESIGN FEATURES: Designed with objectives of good view from cockpit, lightness, ease of maintenance, ease of disassembly for transport and storage. Capable of being converted to an amphibian, with additional endplate fins on tailplane. High-mounted engine behind wing; pusher propeller; low-mounted pod fuselage below propeller carries T tail.

Wing aerofoil Gottingen 398 modified to enhance low-speed handling; constant wing chord; dihedral 1° 30'; twist 1°; strut-braced wings easily detachable at centreline joint.

FLYING CONTROLS: Conventional and manual. Ailerons and elevator are actuated by aluminium pushrods, rudder by cables and pushrods. Electrically actuated half-span flaps and tabs; aileron deflections +20/-14°, elevator +22/-14°, rudder ±23°; flap deflections 10, 20 and 30°; centrally mounted elevator tab for trimming. Full dual controls (sidestick and rudder) and throttle.

STRUCTURE: Fuselage, wings, tail unit and landing gear manufactured from carbon fibre sandwich with Kevlar for strengthening in some areas, such as the cabin. Fuselage constructed of right and left halves bonded together, containing nine bulkheads. Wings built round two C-section spars. Sky Arrow 450 and 480 series have aluminium wings which can be replaced by carbon fibre units. Horizontal tail surfaces of aluminium.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring; multilayer carbon- and glass fibre cantilever mainwheel legs with optional wheel fairings and hand operated hydraulic disc brakes. Steel/carbon fibre castoring nose leg with rubber and spring shock-absorber.

Twin amphibious floats optional. 710RG has retractable landing gear with mainwheels housed in two fuselage-mounted pods.

POWER PLANT: **500TF:** One 59.6 kW (79.9 hp) Rotax 912 UL flat-four four-stroke, driving a two-blade fixed-pitch propeller via 1:2.27 reduction gear.

450TS, 450TGS and 480TS: One 73.5 kW (98.6 hp) Rotax 912 ULS driving a two-blade fixed-pitch propeller via 1:2.43 reduction gear; three-blade propeller standard on 450TGS. **600 Sport:** As 450TS, but with three-blade ground-adjustable propeller.

650TCS and 650TCNS: One 73.5 kW (98.6 hp) Rotax 912 S2 driving a Hoffmann HO176 -174 177CLD wood/composites, two-blade, constant-speed propeller via 1:2.43 reduction gear.

710RG: As 650TCS but with Rotax 912 S3 engine of same horsepower driving a HO-V352 wood/composites, two-blade, constant-speed propeller. Optional 88 litre (23.25 US gallon; 19.36 Imp gallon) fuel tank.

Fuel capacity (all) 68 litres (18.0 US gallons; 15.0 Imp gallons), of which 67 litres (17.8 US gallons; 14.8 Imp gallons) are usable. Tank behind rear seat.

ACCOMMODATION: Two seats in tandem; sideways-opening tinted canopy; baggage compartments below and behind rear seat.

SYSTEMS: Dual hydraulic brakes. Electrical system includes 12 V 14 Ah battery; alternator, 12 V 19 Ah battery optional.

AVIONICS (650 series and 710RG): **Comms:** Single Bendix/King KX-125 nav/com, dual optional; KT-76A transponder; altitude encoder; audio panel with voice-activated intercom; two Sigtronics headsets; ELT.

Flight: Optional Bendix/King KLX-155 nav/com with KI 204 indicator or Garmin GNS-430 nav/com/GPS with GI-106A indicator.

Instrumentation: ASI; altimeter; rate of climb indicator; attitude indicator; directional gyro; turn-and-bank indicator; magnetic compass; pitch trim indicator; tachometer; fuel quantity, fuel pressure, oil temperature, oil pressure, water temperature and vacuum gauges; ammeter/voltmeter; flight hours meter; OAT gauge, and digital chronometer, all standard.

EQUIPMENT: Optional handicapped pilot kit comprises sidestick controller on port cockpit console for rudder and throttle inputs, enabling the aircraft to be flown by pilots unable to use their legs; baggage compartment accommodates folding wheelchair. Fitted trailer for road transportation, with hydraulic loading system, optional.

DIMENSIONS, EXTERNAL:

Wing span: all	9.70 m (31 ft 9 3/4 in)
Wing chord, constant	1.40 m (4 ft 7 in)
Wing aspect ratio	7.0
Length overall: all	7.60 m (24 ft 11 1/4 in)
Height overall: all	2.60 m (8 ft 6 3/4 in)
Tailplane span: all	2.80 m (9 ft 2 1/4 in)
Tailplane chord: all	0.75 m (2 ft 5 1/2 in)
Wheel track: (except RG)	1.75 m (5 ft 9 in)
710RG	1.52 m (5 ft 0 in)
Propeller diameter: 650	1.75 m (5 ft 8 3/4 in)
710RG	1.70 m (5 ft 7 in)

AREAS:

Wings, gross: all	13.50 m ² (145.3 sq ft)
-------------------	------------------------------------

WEIGHTS AND LOADINGS:

Weight empty: 450TGS	287 kg (633 lb)
450TS	286 kg (631 lb)
480TS	298 kg (657 lb)
500TF	335 kg (739 lb)
600 Sport	375 kg (827 lb)
650TCS, 650TCNS	400 kg (882 lb)
710RG	475 kg (1,047 lb)
Max T-O weight: 450TS, 450TGS	450 kg (992 lb)
480TS	480 kg (1,058 lb)
500TF	500 kg (1,102 lb)
600 Sport	600 kg (1,323 lb)
650TCS, 650TCNS	650 kg (1,433 lb)
710RG	710 kg (1,565 lb)
Max wing loading:	
450TS, 450TGS	33.3 kg/m ² (6.83 lb/sq ft)
480TS	35.6 kg/m ² (7.28 lb/sq ft)
500TF	37.0 kg/m ² (7.59 lb/sq ft)
600 Sport	44.4 kg/m ² (9.09 lb/sq ft)
650TCS, 650TCNS	48.2 kg/m ² (9.86 lb/sq ft)
710RG	52.6 kg/m ² (10.77 lb/sq ft)
Max power loading:	
450TS, 450TGS	6.12 kg/kW (10.06 lb/hp)
500TF	8.39 kg/kW (13.78 lb/hp)
600 Sport	8.16 kg/kW (13.41 lb/hp)

650TCS, 650TCNS	8.84 kg/kW (15.53 lb/hp)
710RG	9.66 kg/kW (15.87 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE):	
450TS, 450TGS, 480T, 480TS, 500TF	121 kt (224 km/h; 139 mph)
600 Sport, 650TCS, 650TCNS, 710RG	132 kt (244 km/h; 151 mph)
Max level speed at S/L:	
450TS, 450TGS, 480TS, 500TF	108 kt (200 km/h; 124 mph)
600 Sport, 650TCS, 650TCNS, 710RG	107 kt (198 km/h; 123 mph)
Cruising speed at 75% power at S/L:	
500TF	90 kt (167 km/h; 104 mph)
450TS, 450TGS, 480TS, 600 Sport	92 kt (170 km/h; 106 mph)
650TCS, 650TCNS	97 kt (180 km/h; 112 mph)
710RG	95 kt (176 km/h; 109 mph)
Stalling speed, power off, flaps down:	
450TS, 450TGS	33 kt (62 km/h; 38 mph)
480TS	34 kt (63 km/h; 40 mph)
500TF	35 kt (65 km/h; 41 mph)
600 Sport	38 kt (70 km/h; 44 mph)
650TCS, 650TCNS	40 kt (75 km/h; 47 mph)
710RG	42 kt (78 km/h; 48 mph)
Service ceiling: except 710RG	
710RG	4,100 m (13,460 ft)
Max rate of climb at S/L:	
450TS, 450TGS	384 m (1,260 ft)/min
480TS	372 m (1,220 ft)/min
500TF	274 m (900 ft)/min
600 Sport	318 m (1,043 ft)/min
650TCS, 650TCNS	258 m (846 ft)/min
710RG	183 m (600 ft)/min
T-O run: 450TS, 450TGS	
480TS	100 m (330 ft)
500TF, 600 Sport	115 m (380 ft)
650TCS, 650TCNS	145 m (480 ft)
710RG	177 m (585 ft)
T-O to 15 m (50 ft): 450TS, 450TGS	
480TS	180 m (590 ft)
500TF	160 m (525 ft)
600 Sport	180 m (595 ft)
650TCS, 650TCNS, 710RG	230 m (755 ft)
Landing run: 450TS, 450TGS	
480TS	325 m (1,070 ft)
500TF	380 m (1,250 ft)
600 Sport	75 m (250 ft)
650TCS, 650TCNS	86 m (285 ft)
710RG	100 m (330 ft)
Landing from 15 m (50 ft): 450TG, 450TGS	
480TS	120 m (394 ft)
500TF	135 m (443 ft)
600 Sport	140 m (460 ft)
650TCS, 650TCNS	170 m (560 ft)
710RG	188 m (620 ft)
Max range, 75% power, no reserves:	
450TS, 450TGS, 480TS	200 m (445 ft)
500TF	205 m (675 ft)
600 Sport with increased fuel capacity	215 m (705 ft)
650TCS, 650TCNS	223 m (735 ft)
710RG	
Endurance, 75% power, no reserves:	
450TS, 450TGS, 480TS	340 n miles (630 km; 391 miles)
500TF	380 n miles (703 km; 437 miles)
600 Sport (with increased fuel capacity)	405 n miles (750 km; 466 miles)
650TCS, 650TCNS	329 n miles (610 km; 379 miles)
710RG	314 n miles (581 km; 361 miles)
g limits: all	
	+3.8/-1.9

III ARROW F200 TSJ and F300 FSJ

TYPE: Two-seat lightplane; four-seat lightplane.

PROGRAMME: Design (by Dott Ing Stelio Frati) started in 2000; initially envisaged as family of four, including D-130 primary trainer and a Sport version of F300; manufacture of mockup, and wind tunnel testing, under way mid-2001; production scheduled to begin at end of 2002 but postponed until after 2004, when kit versions were to be offered. Certification of all variants to EASA CS-23 and FAA FAR Pt23 IFR requirements planned, with initial approval of F-300 expected by the end of 2006.

CURRENT VERSIONS: **F200 TSJ:** Aerobatic trainer.

F300 FSJ: Tourer and business aircraft.

DESIGN FEATURES: Typical Stelio Frati design with low wing of tapered planform, and swept fin with long dorsal fillet.

FLYING CONTROLS: Conventional and manual; cable actuated. Horn-balanced elevators and rudder; trim tabs on each aileron and elevator; tab on rudder.

STRUCTURE: All composites; mostly carbon fibre.

LANDING GEAR: Retractable tricycle type; main units retract inwards, nosewheel rearwards.

POWER PLANT: *F200 TSJ:* One 149 kW (200 hp) Textron Lycoming IO-360 flat-four driving a three-blade constant-speed propeller. Max fuel capacity 300 litres (79.2 US gallons; 66.0 Imp gallons).



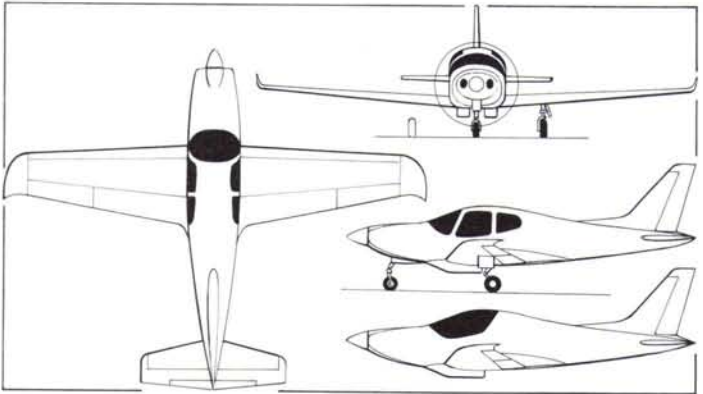
Artist's impression of III Arrow F200 TSJ

1159041



III Arrow F300 FSJ artist's impression

1159042



III Arrow F300, with additional side view (lower) of F200 (James Goulding)

1158780

F300 TSJ: One 231 kW (310 hp) Textron Lycoming IO-550-N2B flat-six with FADEC and three-blade constant-speed propeller. Max fuel capacity 490 litres (129 US gallons; 108 Imp gallons).	
ACCOMMODATION: Two persons, side by side in F200 TSJ; four in F300 FSJ, which has conventional cabin accessed via doors. Control sticks standard. Two baggage compartments at rear of cabin on F300 FSJ, with external baggage door on port side aft of wing.	
DIMENSIONS, EXTERNAL:	
Wing span: F200 TSJ	8.60 m (28 ft 2½ in)
F300 FSJ	10.10 m (33 ft 1½ in)
Wing chord: at root, both	1.78 m (5 ft 10 in)
at tip, both	0.995 m (3 ft 3 in)
Wing aspect ratio: F200 TSJ	6.3
F300 FSJ	7.56
Length overall, both	7.97 m (26 ft 1¾ in)
Height overall, both	3.16 m (10 ft 4½ in)
Tailplane span, both	3.44 m (11 ft 3½ in)
Wheel track, both	3.03 m (9 ft 11¼ in)
Wheelbase, both	2.38 m (7 ft 9¾ in)
AREAS:	
Wings, gross: F200 TSJ	11.70 m² (125.94 sq ft)
F200 TSJ	13.50 m² (145.31 sq ft)
WEIGHTS AND LOADINGS:	
Max T-O weight: F200 TSJ	1,200 kg (2,645 lb)
F300 FSJ	1,550 kg (3,417 lb)
Max baggage weight, both	65 kg (29 lb)
Max wing loading: F200 TSJ	102.53 kg/m² (21.00 lb/sq ft)
F300 FSJ	114.78 kg/m² (23.51 lb/sq ft)
Max power loading: F200 TSJ	8.05 kg/kW (13.22 lb/hp)
F300 FSJ	6.71 kg/kW (11.02 lb/hp)
PERFORMANCE (estimated):	
Max cruising speed: F200 TSJ, F300 FSJ	200 kt (370 km/h; 230 mph)
Cruising speed at 75% power at 1,830 m (6,000 ft):	
F200 TSJ, F300 FSJ	175 kt (324 km/h; 201 mph)
Range, 75% power cruising speed, at 1,830 m (6,000 ft)	
F200 TSJ	900 n miles (1,667 km; 1,036 miles)
F300 FSJ	1,200 n miles (2,222 km; 1,381 miles)
g limits, both	+6/-3

MAGNI

MAGNI GYRO

Via Puccini 10, I-21010 Besnate (VA)
Tel: (+39 0331) 27 48 16
Fax: (+39 0331) 27 48 17
e-mail: magnigyro@logic.it
Web: www.magnigyro.com
FOUNDER: Vittorio Magni

Founded as VPM in 1976 by Vittorio Magni, this company developed the single-seat MT5 and two-seat MT7 gyrocopters. It was renamed Magni Gyro in 1996 and currently produces a range of ultralight autogyros, including the open-cockpit single-seat M-18 Spartan and two-seat M-14 Scout and M-16 Tandem Trainer. In total, around 300 examples were active at the beginning of 2006. In June 2005, the M-22 Voyager was introduced to the range, apparently replacing the M-21, which built only as prototype.

MAGNI M-16 TANDEM TRAINER

TYPE: Two-seat autogyro ultralight/kitbuilt.
PROGRAMME: Current production Magni aircraft.
CURRENT VERSIONS: **Tandem Trainer:** As described.
COSTS: Kit EUR75,895; ready-to-fly EUR79,065 both with Rotax 914 (2004).
DESIGN FEATURES: Open, tandem seating. Pod and boom fuselage with sweptback tailplane and triple fins; rudder on central fin only.
STRUCTURE: Chrome-alloy 4130 steel; TIG welded; glass fibre pod.
LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, spring cantilever mainwheel legs with glass fibre wheel fairings. Unfaired nosewheel.
POWER PLANT: One turbocharged 84.6 kW (113.4 hp) Rotax 914 UL flat-four with electric starter, driving a ground-adjustable pitch, three-blade, carbon fibre Arplast pusher propeller. Optionally, 73.5 kW (98.6 hp) Rotax 912 ULS can be fitted. Fuel in integral cockpit seat/tank of epoxy/glass fibre, capacity 72 litres (19.0 US gallons; 15.8 Imp gallons).
EQUIPMENT: Optional 150 litre (39.6 US gallon; 33.0 Imp gallon) agricultural spray gear.
DIMENSIONS, EXTERNAL:
Rotor diameter 8.53 m (27 ft 11¾ in)
Length overall 4.65 m (15 ft 3 in)
Height overall 2.60 m (8 ft 6¼ in)
Width overall 1.80 m (5 ft 10¾ in)
Propeller diameter 1.70 m (5 ft 7 in)
WEIGHTS AND LOADINGS:
Weight empty 270 kg (595 lb)
Max T-O weight: Europe 450 kg (992 lb)
USA 550 kg (1,212 lb)
PERFORMANCE:
Max level speed 100 kt (185 km/h; 115 mph)
Cruising speed 78 kt (145 km/h; 90 mph)
Max rate of climb at S/L 300 m (984 ft)/min
Service ceiling 3,500 m (11,480 ft)
T-O run 70 m (230 ft)
Landing run up to 30 m (100 ft)
Range, no reserves 260 n miles (481 km; 299 miles)
Endurance 3 h



Magni M-16 Tandem Trainer (Paul Jackson) 1159365

MAGNI M-22 VOYAGER

TYPE: Two-seat autogyro ultralight/kitbuilt.
PROGRAMME: Introduced in June 2005 as a replacement for, and improvement to, the M-16 Tandem Trainer; optimised for cross-country flights.
COSTS: Kit EUR75,895; ready-to-fly EUR79,065; both with Rotax 914 (2004).
DESIGN FEATURES: Partially enclosed; tandem seating. Pod and boom fuselage with sweptback tailplane and triple fins; rudder on central fin only. Streamlined side pods with external doors provide baggage capacity.
STRUCTURE: Chrome-alloy 4130 steel; TIG welded; glass fibre pod.
LANDING GEAR: Tricycle type; fixed. Fuselage-mounted, spring cantilever mainwheel legs with glass fibre wheel fairings. Unfaired nosewheel.
POWER PLANT: One turbocharged 84.6 kW (113.4 hp) Rotax 914 UL flat-four with electric starter, driving an Arplast ground-adjustable pitch, three-blade carbon fibre pusher propeller. Fuel in integral cockpit seat/tank of epoxy/glass fibre, capacity 72 litres (19.0 US gallons; 15.8 Imp gallons).
ACCOMMODATION: Flight controls in front cockpit only.
DIMENSIONS, EXTERNAL:
Rotor diameter 8.53 m (27 ft 11¾ in)
Length overall 4.655 m (15 ft 3¼ in)
Height overall 2.60 m (8 ft 6¼ in)
Width overall 1.80 m (5 ft 10¾ in)
Propeller diameter 1.70 m (5 ft 7 in)
DIMENSIONS, INTERNAL:
Baggage compartment 0.15 m³ (5.3 cu ft)
WEIGHTS AND LOADINGS:
Weight empty 272 kg (600 lb)
Max T-O weight: Europe 450 kg (992 lb)
US 550 kg (1,212 lb)
PERFORMANCE:
Max operating speed 100 kt (185 km/h; 115 mph)
Normal cruising speed 78 kt (145 km/h; 90 mph)
Max rate of climb at S/L 300 m (984 ft)/min
Service ceiling 3,500 m (11,480 ft)
T-O run 70 m (230 ft)
Landing run 0 to 30 m (0 to 100 ft)
Range with max fuel 259 n miles (481 km; 299 miles)



Magni M-22 Voyager prototype 1159286

MB AVIO

MB AVIO
Zona Industriale Capitan Loreto di Spello, Perugia
Tel/Fax: (+39 0742) 30 14 90
e-mail: info@mbavio.it
Web: www.mbavio.it

Little information has been released concerning the company's C26 ultralight, which now appears to be in production.

MB AVIO C26

TYPE: Side-by-side ultralight.
PROGRAMME: Prototype (I-6699) flying by 2002; in production by 2004. One (I-7344) marked in spurious Italian military camouflage and insignia.
COSTS: EUR67,000, plus tax (2004).
DESIGN FEATURES: Low, constant-chord wing; sweptback fin and moderately tapered tailplane.
FLYING CONTROLS: Conventional and manual. Horn-balanced rudder and elevators. Flaps.
STRUCTURE: Generally of metal. All control surfaces have fluted skins.
LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted spring cantilever mainwheel legs.
POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS liquid-cooled flat four driving a three-blade propeller.
DIMENSIONS, EXTERNAL:
Wing span 8.30 m (27 ft 2¾ in)
Length overall 6.80 m (22 ft 3¾ in)



Prototype MB Avio C26 (Geoffrey P Jones) 1044615

WEIGHTS AND LOADINGS:
Weight empty 281 kg (619 lb)
Max T-O weight 450 kg (992 lb)
PERFORMANCE:
Never-exceed speed (VNE) 162 kt (300 km/h; 186 mph)
Max level speed 119 kt (220 km/h; 137 mph)
Cruising speed at 75% power 103 kt (190 km/h; 118 mph)
Stalling speed 35 kt (64 km/h; 40 mph)
Endurance 6 h
g limits +6/-6

OMA SUD

OMA SUD SKY TECHNOLOGIES SPA

via Marra (loc Silvagni), I-81043 Capua (CE)

Tel: (+39 0823) 62 24 47

Fax: (+39 0823) 62 19 42

e-mail: sales@omasud.it

Web: www.omasud.it

Company established in 1988 as airframe subcontractor, including work for Airbus and Boeing. Began design activities in 2003, initial product being Skycar, developed jointly with Israel Aircraft Industries.

Preliminary details of the Skycar were published at the 2005 Paris Air Show and on 4 November 2005 co-development agreement signed with Rucker Aerospace GmbH of Germany.

OMA SUD SKYCAR

TYPE: Five-seat utility twin.

PROGRAMME: Development began 2003 in conjunction with Israel Aircraft Industries: wing aerodynamic design verification subcontracted to VulcanAir; EASA/FAR Pt 23 certification expected in 2007, application having been made on 17 May 2004. No further progress reports by mid-2006.

DESIGN FEATURES: Twin-boom pusher with high, constant-chord wing and high tailplane with sweptback leading-edge; sweptback, tapered twin fins; upturned wingtips. Deep tailbooms are continuations of fuselage sides.

FLYING CONTROLS: Manual. Actuation by pushrods. All-moving tailplane with anti-balance tab port; flaps; twin rudders. Tailplane and rudder trim operated electrically.

LANDING GEAR: Tricycle type; retractable. Electrical actuation, with manual emergency deployment.

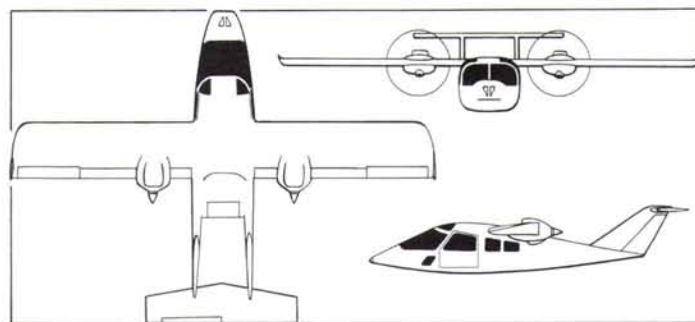
POWER PLANT: Two 149 kW (200 hp) Textron Lycoming IO-360-C1E6 flat-four piston engines, each driving a Hartzell two-blade metal constant-speed (hydraulic), fully feathering, pusher propeller.

Fuel tanks in wings: combined capacity 500 litres (132 US gallons; 110 Imp gallons).



Artist's impression of OMA SUD Skycar

1127791



OMA SUD Skycar five-seat twin (James Goulding)

1129589

ACCOMMODATION: Five persons: two individual front seats; three on bench seat behind; baggage area to rear, accessible from cabin, but also with 'beaver tail' (horizontally split) door at rear, between tailbooms. Rear seats removal for additional cargo space.

SYSTEMS: Optional wing de-icing.

DIMENSIONS, EXTERNAL:

Wing span	12.00 m (39 ft 4 1/2 in)
Wing chord (constant)	1.40 m (4 ft 7 in)
Length overall	8.92 m (29 ft 3 1/4 in)
Height overall	2.55 m (8 ft 4 1/2 in)
Tailplane span	4.30 m (14 ft 1 1/4 in)
Propeller diameter	1.83 m (6 ft 0 in)

DIMENSIONS, INTERNAL:

Cabin volume	5.0 m ³ (177 cu ft)
Baggage volume	1.8 m ³ (64 cu ft)

WEIGHTS AND LOADINGS:

Weight empty	1,200 kg (2,646 lb)
Payload: max	500 kg (1,102 lb)
with max fuel	335 kg (739 lb)
Max fuel weight	360 kg (794 lb)
Max T-O weight	1,895 kg (4,177 lb)
Max ramp weight	1,915 kg (4,222 lb)
Max landing weight	1,800 kg (3,968 lb)
Max zero-fuel weight	1,700 kg (3,748 lb)

PERFORMANCE:

Max cruising speed	186 kt (344 km/h; 214 mph)
Stalling speed	60 kt (112 km/h; 70 mph)
Max rate of climb at S/L	518 m (1,700 ft)/min
Rate of climb at S/L, OEI	168 m (550 ft)/min
Service ceiling	5,486 m (18,000 ft)
T-O run	387 m (1,270 ft)
Landing run	527 m (1,730 ft)
Range at 65% power at 2,440 m (8,000 ft), 45 min reserves at 45% power	
with max payload	570 n miles (1,055 km; 655 miles)
with max fuel	1,170 n miles (2,166 km; 1,346 miles)

PIAGGIO

PIAGGIO AERO INDUSTRIES SPA

Via Cibrario 4, I-16154 Genova Sestri, Genova

Tel: (+39 010) 648 11

Fax: (+39 010) 648 13 09

e-mail: commerciale@piaggioaero.it

Web: www.piaggioaero.com

CEO: José Di Mase

CHAIRMAN: Piero Ferrari

VICE-PRESIDENT, SALES: Massimo Isidori

GENERAL MANAGER: Giorgio Giorgi

DEPUTY DIRECTOR, MARKETING AND COMMERCIAL: Giuliano Felten

WORKS:

Genova Sestri and Finale Ligure (SV)

BRANCH OFFICE:

Via A Gramsci 34, I-00197 Roma

SUBSIDIARIES:

Piaggio Aero France SAS

Le Centaure-Nice Leader, 66 Route de Grenoble, F-06200 Nice, France

Tel: (+33 4) 89 88 77 77

Fax: (+33 4) 89 88 77 55

DIRECTOR: Alfonso Ruggiero

Piaggio America Inc

2 Exchange Street, Greenville, South Carolina 29605, USA

Tel: (+1 864) 277 39 79

Fax: (+1 864) 277 43 78

CEO AND PRESIDENT: Tom Appleton

Piaggio began aircraft production at Genoa Sestri in 1916 and later extended to Finale Ligure; Rinaldo Piaggio SpA formed 29 February 1964; covered floor area 50,000 m² (538, 200 sq ft) at Sestri and 70,000 m² (753,475 sq ft) at Finale Ligure. Workforce 775 and 525, respectively, in 2004, plus 35 at Naples research centre. Early in 1993, Rinaldo Piaggio restructured with Piaggio family retaining 19 per cent of stock; Alenia acquired 31 per cent holding in Piaggio in 1988 (adjusted to 24.5 per cent in 1992), but raised to 30.9 per cent in early 1993 following further restructuring and reorganisation. Industrie Aeronautiche and Meccaniche Rinaldo Piaggio SpA placed in administration in November 1994; following takeover in November 1998 by Turkish state holding company Tushav, which acquired 51 per cent of stock, was renamed Piaggio Aero Industries SpA, with balance of stock held by Italian investment group

Aero Trust via Royal Bank of Canada (44 per cent), CSC of Italy (3 per cent) and the Buitoni family (2 per cent). However, Aero Trust share increased to 60 per cent in June 1999, returning company to Italian control. Sviluppo Italia, the Italian government industrial investment agency, acquired a 20 per cent share in Piaggio in September 2003, with an investment of EUR20 million.

Two new subsidiaries were established in 2000: Piaggio Aero France SAS at Nice, France, which is a branch of Piaggio's Finale Ligure engineering department; and Piaggio America Inc, based in Greenville, South Carolina, but scheduled to move to Palm Beach International Airport, Florida, in first quarter 2004. In April 2003, Piaggio purchased Foxair, a corporate and air ambulance operator with a fleet of six aircraft (mainly Avantis), which is the North American support organisation for the P.180 Avanti. In April 2005, Mubadala Development of Abu Dhabi acquired a 35 per cent share of Piaggio Aero.

Piaggio also licence-produces engines, including the RRT1 RTM 322 and mobile shelters; manufactures subassemblies of Alenia (Lockheed Martin) C-27J, Lockheed Martin F-35 Joint Strike Fighter and Dassault Falcon 2000 and overhauls and supports Viper, T53 and T55 power plants.

PIAGGIO P.180 AVANTI

English name: Forward

TYPE: Business twin-turboprop.

PROGRAMME: Design studies began 1979; launched 1982; Gates Learjet became partner in 1983, but withdrew for economic reasons on 13 January 1986; all existing Learjet P.180 tooling and first three forward fuselages transferred to Piaggio; first flights of two prototypes I-PJAV 23 September 1986 and I-PJAR 14 May 1987; two static test fuselages; first Italian certification 7 March 1990; first flight full production P.180 (I-RAIH/N180BP), 30 May 1990; Italian certification 7 March 1990; US certification 2 October 1990; first customer delivery (N180BP to Robert Pond) 30 September 1990; French certification March 1993. P.180 is certified to Italian RAI 223 and FAR Pt 23 including single pilot, night and day, VFR/IFR and flight into known icing. RVSM approval announced 24 July 2002. FAA Domestic RVSM and Canadian RVSM approvals granted in 2003. UK Civil Aviation Authority approval granted 5 June 2004.

On 5 October 2003 an Avanti established a new Class C.I.E world speed record while en route to the NBAA Convention, completing the 854 n miles (1,582 km; 983 mile flight from Chicago-Midway Airport to Orlando Executive Airport in 2 hours, 18 minutes, 12 seconds at an average speed of 374 kt (693 km/h; 430 mph).

CURRENT VERSIONS: **Avanti:** Increased gross weight giving higher payload/range decided 1991 and early aircraft retrofitted with minor modifications to allow new weights; weights increased again in 1992. Modified version relaunched in 1997 incorporates changes including fin, rudder and foreplane of aluminium alloy construction and increased fuel capacity.

Avanti II: As described. Upgraded version announced at the NBAA Convention in Las Vegas in October 2004, when first flight of the prototype was said to be imminent. Features



Piaggio P.180 Avanti in Italian Air Force service (Paul Jackson)

1159147

include Rockwell Collins Pro Line 21 avionics package with three-tube 254 × 203 mm (10 × 8 in) active matrix liquid crystal EFIS display. Prototype I-RAIL (c/n 1105) made public debut at NBAA Convention, Orlando, Florida 9 to 11 November 2005, having been certified by EASA on 21 October 2005. First delivery, to a Swiss customer, took place in January 2006. Avanti II package may become available as a retrofit upgrade for earlier aircraft. PT6-66B engine to be certified for Avanti in late 2006 or early 2007, allowing increased maximum take-off weight.

Data apply to this version. However, from January 2006, option available of 5,488 kg (12,100 lb) MTOW; 5,511 kg (12,150 lb) ramp weight; and 5,216 kg (11,500 lb) MLW. CUSTOMERS: Total 30 (including prototypes) built by early 1995. 31st followed in early 1999; eight delivered in 2000, 12 in 2001, 16 in 2002, 20 in 2003, 16 in 2004, 14 in 2005, and two in the first six months of 2006. Total of 24 scheduled for production in 2006, and 30 in 2007. Hundredth (N134SL c/n 1100) rolled out 9 June 2005 and subsequently delivered to Avantair. Italian Air Force ordered six for communications; first delivery MM62159 14 May 1993; further five (three for Italian Army; two for SNPC civil protection service) ordered 1994, of which first, MM62167, handed over on 28 July 1997 and delivered 29 August 1997, and second and third delivered March-April 1998, with two SNPC aircraft following in late 1998 and mid-1999. Additional six aircraft delivered for military use by mid-2004, including three for Italian Navy and at least one in navigation aids calibration role for IAF.

First new aircraft delivery since company reorganisation took place on 2 February 2000 to Aviation Services for Business Aircraft Inc, Portland, Oregon (N680JP). Recent customers include Italian car manufacturer Ferrari, which took delivery of the first of two aircraft (I-FXRB) on 18 May 2000 (these operated by Foxair, which is 75% owned by Piaggio); the Greek Ministry of Health, which ordered two in EMS configuration and, although built, these were not delivered; Locafit (Italy); CIT Group Equipment Financing (Arizona, USA); US charter broker Skyline Aviation, which ordered eight in 2002; Avia Aviation of Canada which has ordered six for delivery from early 2003; Pan Européenne Air Service of France, which ordered one for delivery in May 2003, plus one option; Maserati of Italy, which has taken delivery of one; Euro SkyLink UK, which ordered two plus three options of which first (G-OESL) delivered at the European Business Aviation Convention and Exhibition at Geneva 26 May 2004 but subsequently sold; Blue Panorama Airlines of Italy, which ordered two for delivery in April and July 2004; and Avantair, of Fairfield, New Jersey, ordered 43 Avantis in 2004, and 36 Avanti IIs in 2005, last named for delivery between 2007 and 2010. Order backlog for Avanti IIs stood at 98 in July 2006.

COSTS: Avanti USD5.35 million (2004); Avanti II USD6.195 million (2005). Avantair contract for 36 Avanti IIs valued at USD230 million (2005).

DESIGN FEATURES: Intended to provide jet-type speeds with turboprop economy. Three-surface control with foreplane and T tail to allow unobstructed cabin with maximum headroom to be placed forward of mid-mounted wing carry-through structure; pusher turboprops aft of cabin and wing reduce cabin noise and propeller vortices on wing, assisting in achievement of 50 per cent laminar flow; mid-wing avoids root bulges of low-set wings and spar does not pass through cabin; lift from foreplane allows horizontal tail to act as lifting surface and thereby reduce required wing area by 34 per cent.

Laminar flow wing section Piaggio PE 1491 G (mod) at root, PE 1332 G at tip; thickness/chord ratio 13 per cent at tip, 14.5 per cent at root; dihedral 2°; sweepback 1° 11' 24"; taper ratio 0.34; foreplane aerofoil Piaggio PE 1300 GN4 unswept; 5° anhedral on foreplane and tailplane; latter sweptback 29° 48' at 25 per cent chord. Tailplane swept 40° at 25 per cent chord.

FLYING CONTROLS: Manual. Aerodynamically and mass-balanced elevators; horn- and mass-balanced rudder. Variable incidence swept tailplane for trim; electrically actuated trim tab in starboard aileron and in rudder; two strakes under tail; electrically actuated outboard

Fowler and inboard single-slotted flaps on wing synchronised with single-slotted flaps in foreplanes; three flap positions: dual control circuits; foreplane stalls before wing, providing pitch-down moment. All control surfaces have sealed gaps and are aerodynamically balanced. No dampers or stick-pusher.

STRUCTURE: Airframe 90 per cent aluminium alloy and 10 per cent composites. Fuselage precision stretch-formed in large seamless sections and inner structure matched to precise outer contour in innovative 'outside-in' construction technique: CFRP in high-stress areas: 'Working skin' wing main box, with machined spars and panels, plus integral stiffeners; two main spars; third spar runs from nacelle to fuselage centreline; aluminium leading-edges and aluminium and composites trailing-edges, both connected to main box. Similar construction of forward wing, which connected to lower fuselage at four points and has aluminium alloy leading-edges with electric de-icing blanket and full-depth honeycomb aluminium flaps. Tailplane has two-spar sandwich construction of graphite fabric on Nomex honeycomb core; elevators are single-spar and full-depth aluminium honeycomb with aluminium skins. Fin attached to tailcone bulkheads by four vertical aluminium machined spars; chemically milled aluminium sheet skins. Two-spar rudder, with aluminium alloy skin and carbon fibre and foam core.

Composites parts manufactured by Moreggio (nacelles) and Salver (horizontal stabiliser), wings and tail section and final assembly by Piaggio in Genoa. Interior completion of aircraft for the North American market is undertaken by Stevens Aviation of Greenville, South Carolina.

LANDING GEAR: Dowty Aerospace hydraulically retractable tricycle type, with Goodrich single-wheel main units and twin-wheel nose unit. Main units retract rearward into sides of fuselage; nose unit retracts forward. Emergency hand pump. Dowty hydraulic shock-absorbers. Electro-hydraulic nosewheel steering available through ±20° on take-off and ±50° for taxiing. Tyre sizes 6.50-10 (12-ply, main) and 5.00-5 (8-ply, nose). Goodrich hydraulic, multidisc carbon brakes.

POWER PLANT: Two 1,216 kW (1,630 shp) Pratt & Whitney Canada PT6A-66B turboprops, flat rated at 634 kW (850 shp), each mounted above wing in all-composites nacelle and driving a Hartzell HC-E5N five-blade aluminium constant-speed fully feathering reversible-pitch pusher propeller; propellers handed to counterrotate; blades LE8218 with HC-E5N-3 hubs; port propeller rotates anticlockwise, viewed from rear. Fuel in two fuselage tanks and two wing tanks; total fuel capacity 1,597 litres (422 US gallons; 351 Imp gallons), of which 1,583 litres (418 US gallons; 348 Imp gallons) are usable. Tanks divided into left and right groups (plus primary and secondary collector tanks) which are independent, except during optional pressure refuelling via single point on starboard centre-fuselage. Gravity refuelling point in upper part of fuselage.

ACCOMMODATION: Crew of one or two on flight deck; certified for single-pilot operation. Seating in main cabin for up to nine passengers, with galley, fully enclosed lavatory and coat storage area; choice of nine-passenger high-density or five-seat VIP cabins. Club passenger seats are armchair type, which can be reclined, tracked and swivelled, and locked at any angle. Foldaway tables can be extended between facing club seats. Two-piece wraparound electrically heated windscreen. Rectangular cabin windows, including one emergency exit at front on starboard side. Indirect lighting behind each window ring, plus individual overhead lights. Airstair door at front on port side is horizontally split, upper part forward-opening. Baggage compartment aft of rear pressure bulkhead, with upward-opening door immediately aft of wing on port side. Entire cabin area pressurised and air conditioned. New interior by Sergio Pininfarina under development in mid-1999; total of 15 interior options available.

SYSTEMS: Hamilton Sundstrand R70-3WG three-wheel air-cycle bleed air ECS, with maximum pressure differential of 0.62 bar (9.0 lb/sq in) maintaining sea level cabin altitude to 7,315 m (24,000 ft) and a 2,012 m (6,600 ft) cabin altitude at 12,500 m (41,000 ft). Single hydraulic system driven by electric motor, with hand pump for emergency back-up, for landing gear (up to 207 bar; 3,000 lb/sq in), brakes and steering (up to 83 bar; 1,200 lb/sq in). Electrical system powered by two 400 A 28 V starter/Lear Siegler generators and 25 V 38 Ah Ni/Cd battery, with triple-redundant essential bus. Two 250 VA static inverters for AC. External power receptacle above port mainwheel well. Scott 1.13 m³ (40 cu ft) oxygen system. Hot air anti-icing of main wing outer and inner leading-edges; electric anti-icing for foreplane and windscreen; rubber boot for engine intakes, with dynamic particle separator; propeller blades de-iced by engine exhaust.

AVIONICS: Rockwell Collins ProLine 21 as core system.

Comms: Dual Rockwell Collins VHF com; dual TDR-94D Mode S transponders; dual Baker M-1035 audio panels.

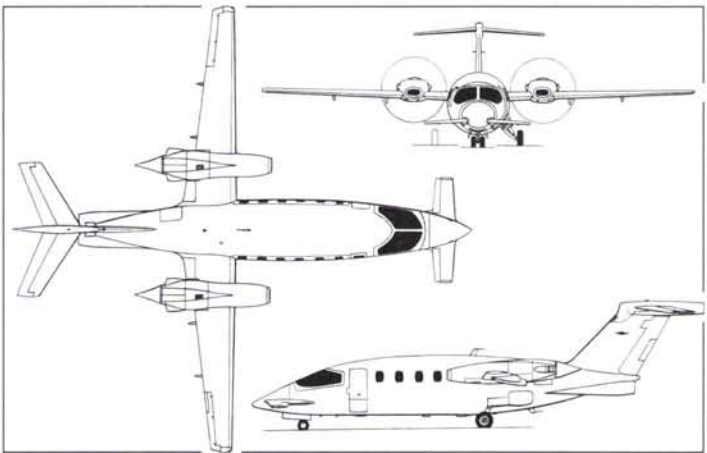
Radar: RTA-852 turbulence detection radar.

Flight: Dual FGC-3003 flight guidance systems; FMC-3000 FMS; NAV-4000 VOR/ILS/MKR/ADF; NAV-4500 VOR/ILS/MKR; DME-4000; AHS-3000 AHRS; ALT-4000 radio altimeter; GPS-4000A; L-3 Communications TCAS I Skywatch HP; TAWS Class B.

Instrumentation: Three 254 × 203 mm (10 × 8 in) LCD adaptive flight displays for PFD (two) and MFD (one) functions.

DIMENSIONS, EXTERNAL:

Wing span	14.035 m (46 ft 0½ in)
Foreplane span	3.355 m (11 ft 0 in)
Wing chord: at root	1.82 m (5 ft 11¼ in)
at tip	0.62 m (2 ft 0½ in)



Piaggio P.180 Avanti corporate transport (Dennis Punnett)

0507420



Prototype Piaggio P.180 Avanti II at its public debut in Orlando, November 2005 (Paul Jackson)

1151484

Foreplane chord: at root	0.79 m (2 ft 7 in)
at tip	0.55 m (1 ft 9 3/4 in)
Wing aspect ratio	12.3
Foreplane aspect ratio	5.1
Length overall	14.41 m (47 ft 3 1/2 in)
Fuselage: Length	12.53 m (41 ft 1 1/4 in)
Max width	1.95 m (6 ft 4 3/4 in)
Height overall	3.98 m (13 ft 0 3/4 in)
Tailplane span	4.26 m (13 ft 11 3/4 in)
Wheel track	2.84 m (9 ft 4 in)
Wheelbase	5.79 m (19 ft 0 in)
Propeller diameter	2.16 m (7 ft 1 in)
Propeller ground clearance	0.795 m (2 ft 7 1/4 in)
Distance between propeller centres	4.125 m (13 ft 6 1/2 in)
Passenger door (fwd, port): Height	1.345 m (4 ft 5 in)
Width	0.61 m (2 ft 0 in)
Height to sill	0.58 m (1 ft 10 3/4 in)
Baggage door (rear, port): Height	0.60 m (1 ft 11 3/4 in)
Width	0.70 m (2 ft 3 1/2 in)
Height to sill	1.38 m (4 ft 6 1/2 in)
Emergency exit (stbd): Height	0.67 m (2 ft 2 1/4 in)
Width	0.48 m (1 ft 7 in)

DIMENSIONS, INTERNAL:

Passenger cabin (excl flight deck):	
Length	4.55 m (14 ft 11 1/4 in)
Max width	1.85 m (6 ft 0 3/4 in)
Max height	1.75 m (5 ft 9 in)
Volume	10.6 m³ (375 cu ft)
Flight deck: Length	1.45 m (4 ft 9 in)
Volume	2.26 m³ (79.8 cu ft)
Baggage compartment: Floor length	1.70 m (5 ft 7 in)
Max length	1.95 m (6 ft 4 3/4 in)
Volume	1.25 m³ (44 cu ft)

AREAS:

Wings, gross	16.00 m² (172.2 sq ft)
Ailerons (total, incl tab)	0.66 m² (7.10 sq ft)
Trailing-edge flaps (total)	1.60 m² (17.23 sq ft)
Foreplane	2.19 m² (23.57 sq ft)
Foreplane flaps (total)	0.58 m² (6.30 sq ft)
Fin	4.73 m² (50.91 sq ft)
Rudder, incl tab	1.05 m² (11.30 sq ft)
Tailplane	3.83 m² (41.23 sq ft)
Elevators (total, incl tabs)	1.24 m² (13.35 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	3,538 kg (7,800 lb)
Max baggage weight:	
cabin floor	23 kg (50 lb)
wardrobe	18 kg (40 lb)
rear compartment	181 kg (400 lb)
Max usable fuel weight	1,271 kg (2,802 lb)
Max payload	907 kg (2,000 lb)
Payload with max fuel	679 kg (1,498 lb)
Max T-O weight	5,465 kg (12,050 lb)
Max ramp weight	5,488 kg (12,100 lb)
Max landing weight	5,194 kg (11,450 lb)
Max zero-fuel weight	4,445 kg (9,800 lb)
Max wing loading	341.7 kg/m² (69.98 lb/sq ft)
Max power loading	4.31 kg/kW (7.09 lb/shp)

PERFORMANCE:

Max operating Mach No (MMO)	0.70
Max operating speed (V _{MO})	260 kt (482 km/h; 299 mph) IAS
Max level speed at FL280	398 kt (737 km/h; 458 mph)
Manoeuvring speed	199 kt (368 km/h; 229 mph)
Cruising speed at max cruise power:	
at FL300	390 kt (722 km/h; 449 mph)
at FL350	374 kt (693 km/h; 430 mph)
at FL390	349 kt (646 km/h; 402 mph)
Stalling speed at max landing weight:	
flaps down	97 kt (180 km/h; 112 mph)
Max rate of climb at S/L	844 m (2,770 ft)/min
Rate of climb at S/L, OEI	204 m (670 ft)/min
Max certified altitude	12,500 m (41,000 ft)
Service ceiling	12,040 m (39,500 ft)
Service ceiling, OEI	7,391 m (24,250 ft)
T-O to 15 m (50 ft) ISA, S/L at max T-O weight	986 m (3,235 ft)
Landing from 15 m (50 ft) at max landing weight, no propeller reversal	1,067 m (3,500 ft)

Range:	
at max range power:	
VFR reserves at FL390	1,793 n miles (3,320 km; 2,063 miles)
Max range, IFR reserves:	
at max range power:	1,507 n miles (2,791 km; 1,734 miles)
at max cruise power:	1,456 n miles (2,696 km; 1,675 miles)
OPERATIONAL NOISE LEVELS (FAR Pt 36):	
Appendix F	76.0 dB(A)
Appendix G	81.8 dB(A)

PIAGGIO P.1XX

TYPE: Business jet.

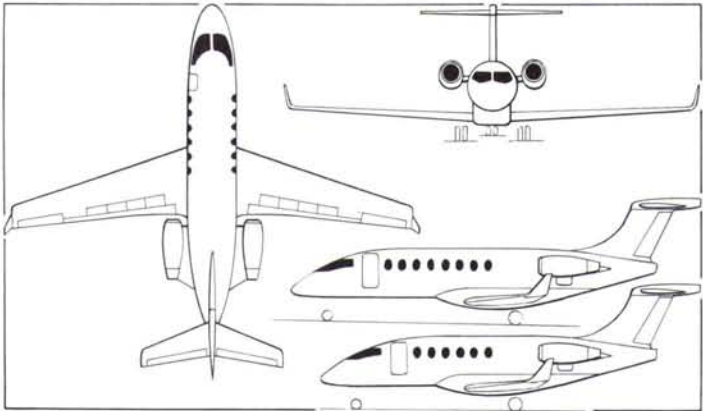
PROGRAMME: First revealed, anonymously, in a market survey conducted by Forecast International in early 2005; then suspected to be related to plans by Piaggio to develop a family of light, light-medium and medium business jets. Design goals include larger cabin cross-section and volume than competing designs; high cruising speed; supercritical wing aerofoil section; new-generation, fully integrated avionics; high utilisation rates; and cross-crew qualification between the different versions. Piaggio conceded responsibility for the design at NBAA Convention, Orlando, Florida, October 2006 and revealed provisional designation P.1XX.

Provisional data for the eight-passenger light-medium variant include a maximum T-O weight of 10,900 kg (24,030 lb); max cruising speed M0.8; certified ceiling 14,325 m (47,000 ft); IFR range 2,300 n miles (4,260 km; 2,647 miles); and price less than USD11 million. The medium jet, which was expected by late 2006 to be selected for further development, would have a longer fuselage accommodating 10 passengers, maximum T-O weight of 13,600 kg (29,982 lb); max cruising speed M0.8; certified ceiling 14,325 m (47,000 ft), IFR range 2,996 n miles (5,550 km; 3,448 miles) and price less than USD13.5 million. Both variants would be powered by two pod-mounted turbofans in the 20.46 kN (4,600 lb st) class and feature fully integrated EFIS avionics, either Honeywell Primus Epic or Collins Pro Line 21 suites. The light jet would seat six to nine passengers and be powered by engines in the Honeywell TFE731 or Pratt & Whitney Canada PW500/PW600 class. The three variants would share 80 per cent commonality of parts.



Artist's impression of proposed Piaggio P.1XX medium jet (Forecast International)

1133987



Piaggio medium business jet, with additional side view of light jet (James Goulding)

1133956

SAI

SOCIETA AERONAUTICA ITALIANA
(ITALIAN AERONAUTICAL SOCIETY)

Via Fillipo Bottazzi 38, I-80126 Napoli
 Tel: (+39 08) 23 49 45 80
 Fax: (+39 08) 18 82 07 82
 e-mail: info@sai aeronautica.com
 Web: www.sai aeronautica.com

FOUNDERS:

Vincenzo Giordano
 Gaetano Iervolino
 Gastone Iervolino

INFORMATION OFFICER: Federica Tevvolino

SAI was established in 1997 to design, market and support ultralight aircraft; conduct aerodynamic research; and manage static and flight certification test programmes.

Sales and production of the G97 Spotter, renamed Sky-MAXX, have been transferred to German Aircraft GmbH.

SG

SG AVIATION

Via Enzo Ferrari, I-04016 Sabaudia (LT)
 Tel: (+39 0773) 51 52 16
 Fax: (+39 0773) 51 14 07
 e-mail: info@stormaircraft.com
 Web: www.stormaircraft.com
 PRESIDENT: Giovanni Salsedo

NORTH AMERICAN AGENT:

SG Aviation America
 26 McEwan Drive, Unit #6, Bolton, Ontario L7E 1E6, Canada
 Tel: (+1 905) 951 05 48
 Fax: (+1 905) 951 06 49
 e-mail: info@sgaviation.com
 Web: www.sgaviation.com

In addition to the Storm series of light aircraft (based on an original Jean Pottier design); and Sea Storm, SG Aviation manufactures spare parts and subassemblies for the Italian Air Force in its 1,800 m² (19,375 sq ft) factory. The workforce numbered 70 in February 2003.

In April 2002, SG launched the high-wing Rally. By 2004, more than 1,000 complete aircraft and kits had been produced and sold to more than 20 countries.

In early 2006, Storm granted a licence to Prestige Aircraft of Jackson, Michigan, to produce aircraft for LSA compliance in the US, with marketing and distribution by Air Elite Aviation.

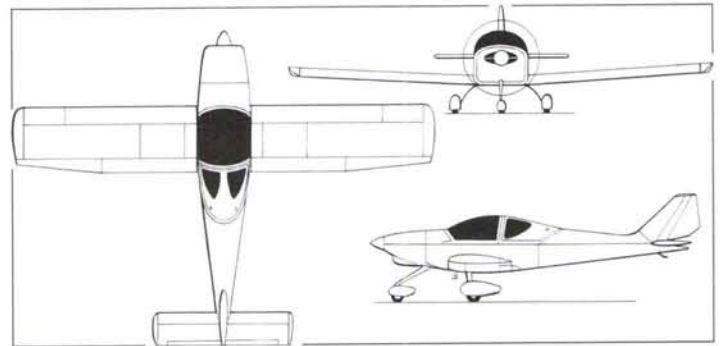
SG STORM

TYPE: Side-by-side lightplane/kitbuilt.

PROGRAMME: Design started 11 February 1989 (Storm 280 SI); construction of prototype started 24 November 1990; first flight March 1991; certified to Aero Club Italia ULM category. Production aircraft manufacture began 29 March 1993; first flight July 1993; first delivery August 1993. US production to LSA standard was expected to begin in August 2006.

CURRENT VERSIONS: Total of three versions currently available, both above and below ultralight weight limit: The **Storm Century**, a development of the Storm 300 Special, was introduced in 2000 and is available in tricycle and tailwheel versions. Other modifications include a lengthened engine cowling, increased fuel capacity using wing tanks, and a baggage compartment behind rear cabin. Also available is the 119 kW (160 hp); and Storm Century '04 development of Century. The Storm 280 E, 280G, 280 SI, 300, 300 Focus, 300 Special, 320 E, 400 Focus, 400 Special and 400TI are no longer available.

Storm 500: Introduced in 2001 in two versions (basic CLK and retractable-gear SLK); is full-four-seat version, available only in tricycle form. No longer available.



SG Storm, nosewheel version (James Goulding)

0011094

Storm RG: First flown 2001; development of 400 with conventional tailplane and modified fin with dorsal fillet. First deliveries in 2002. Prototype being tested with winglets; not standard. Available for both ultralight and VLA markets.

Cyclone: Military version of Storm RG; hardpoint under each wing. Cockpit glazing comprises fixed windscreen; rearward sliding canopy; and fixed rear windows. No known production.

Sea Storm: Unrelated design; described separately.

CUSTOMERS: By early 2003 (no more recent data supplied), over 650 Storms ordered, of which more than 250 were flying. Around 80 per cent are tricycle landing gear versions.

COSTS: Kits: Storm Century EUR17,900; Storm RG EUR23,800; Storm Century '04 EUR18,500. Ready to fly: Storm Century EUR55,800; Storm RG EUR69,500; Storm Century '04 EUR58,400 (all 2006).

DESIGN FEATURES: Extensive use of modern materials and technology. Low, constant-chord wing with tip fence on some versions; sweptback fin including large cutaway base to rudder for all-moving tailplane travel. Quoted build time for kits 600 hours.

Wing thickness/chord ratio 15 per cent; 3° dihedral; 3° incidence.

FLYING CONTROLS: Manual. All-moving tailplane with electrically actuated anti-balance tab on most versions; rudder tab introduced on some recent versions. Storm RG has conventional horizontal tail. Balanced Frise ailerons. All models have Fowler flaps.

LANDING GEAR: Main legs are cantilever sprung. Tricycle versions have tubular steel sprung nosewheel leg steerable ±40°. Hydraulic disc brakes on mainwheels. Speed fairings can be fitted. Matco tyres: mainwheels 15×6.00, pressure 2.00 bar (29 lb/sq in); tailwheel 15 cm (6 in), pressure 1.80 bar (26 lb/sq in). Storm RG has 5.00-5 wheels on all legs; main wheels retract inwards, nosewheel rearwards. No doors.



Storm Century tailwheel version with appropriate registration

1159293

For details of the latest updates to *Jane's All the World's Aircraft* online and to discover the additional information available exclusively to online subscribers please visit
jawa.janes.com



SG Rally 105 UL ultralight version belonging to a Portuguese owner (Geoffrey P Jones)

1044950

POWER PLANT: *Storm Century and Century '04:* One 59.6 kW (79.9 hp) Rotax 912 UL turbocharged four-cylinder four-stroke engine driving a two-blade Rospeller constant-speed metal propeller. Mid-West AE 110 Hawk 78.3 kW (105 hp) rotary engine optional. Fuel capacity 100 litres (26.4 US gallons; 22.0 Imp gallons). Oil capacity 3.5 litres (0.92 US gallon; 0.77 Imp gallon).

Storm RG: One 73.5 kW (98.6 hp) Rotax 912 ULS driving a Duc three-blade propeller or one 84.6 kW (113.4 hp) Rotax 914. Fuel capacity as Storm Century.

ACCOMMODATION: Two persons, side by side, with dual controls; single-piece canopy hinged upwards and forwards. Large baggage area behind cockpit.

SYSTEMS: 12 V battery.

AVIONICS: *Instrumentation:* Option of full IFR fit.

DIMENSIONS, EXTERNAL (A: Century, B: RG with Rotax 912 ULS):

Wing span: A, B	7.80 m (25 ft 7 in)
Length overall: A, B	6.80 m (22 ft 3 3/4 in)
Height overall: B	2.04 m (6 ft 8 1/4 in)

DIMENSIONS, INTERNAL:

Cabin max width: A, B	1.10 m (3 ft 7 1/4 in)
-----------------------	------------------------

AREAS:

Wings, gross: A, B	9.98 m ² (107.4 sq ft)
--------------------	-----------------------------------

WEIGHTS AND LOADINGS:

Weight empty: B (UL)	293 kg (646 lb)
A	320 kg (705 lb)
B (VLA)	350 kg (771 lb)
Max T-O weight: B (UL)	450 kg (992 lb)
A	560 kg (1,234 lb)
B (VLA)	599 kg (1,320 lb)
Max wing loading: A	56.1 kg/m ² (11.49 lb/sq ft)
B (UL)	35.1 kg/m ² (7.18 lb/sq ft)
B (VLA)	60.0 kg/m ² (12.29 lb/sq ft)
Max power loading: A	6.62 kg/kW (10.88 lb/hp)
B (UL)	4.76 kg/kW (7.82 lb/hp)
B (VLA)	8.15 kg/kW (13.39 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE):	
A, B	167 kt (310 km/h; 192 mph)
Max operating speed (VMO):	
A	155 kt (287 km/h; 178 mph)
B	157 kt (290 km/h; 180 mph)
Cruising speed at 75% power:	
B	143 kt (265 km/h; 165 mph)
A	150 kt (278 km/h; 173 mph)
Stalling speed, power off, flaps down:	
A, B	30 kt (55 km/h; 35 mph)
Max rate of climb at S/L: A	420 m (1,378 ft)/min
B	390 m (1,280 ft)/min
Service ceiling: A	6,096 m (20,000 ft)
B	5,485 m (18,000 ft)
T-O run: A	90 m (295 ft)
B	110 m (360 ft)
Landing run: A	120 m (305 ft)
B	140 m (460 ft)
Range with max fuel:	
A	864 n miles (1,600 km; 994 miles)
B	779 n miles (1,444 km; 897 miles)
g limits: A	+4.2/-2
B	+4.5/-2.0

SG SEA STORM

Development and promotion of this amphibious kitbuilt has been taken over by Air Elite Aviation of the US.

SG RALLY

TYPE: Side-by-side ultralight.

PROGRAMME: Aerodynamic studies began 1991; prototype flew in 1993, but development was suspended in favour of Sea Storm and Storm 300, both of which employed the Rally's wing profile. Work resumed in 2000; marketing launched in April 2002 to meet new, more liberal European sport pilot and US Experimental category legislation. US LSA compliant production started early 2006.

CURRENT VERSIONS: **Rally 105 S:** Experimental category or Ultralight version. As described.

Rally 105 UL: Ultralight version only. Empty weight 265 kg (584 lb); MTOW 435 kg (959 lb); reduced fuel and power.

Storm Rally: Built in US by Prestige Aircraft and marketed by Air Elite (which see).

CUSTOMERS: More than 20 sold by February 2004.

COSTS: Kit EUR27,100; ready-to-fly EUR55,800 (2006).

DESIGN FEATURES: High-mounted, strut-braced, constant-chord wings. Low tailplane and sweepback fin mounted on steeply waisted rear fuselage.

Limited aerobatic performance.

FLYING CONTROLS: Conventional and manual. Horn-balanced elevators and rudder. Flight-adjustable tab in starboard elevator. Slotted flaps, settings 0, 10 and 20°.

STRUCTURE: All-composites fuselage, with aluminium wing. Wing section NACA 63-215 mod.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring cantilever mainwheel legs with wheel fairings; 5.00-5 wheels on all legs.

POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL-2 flat-four in Rally UL; 73.5 kW (98.6 hp) Rotax 912 ULS-2 in Rally S, latter driving three-blade ground adjustable WarpDrive propeller. Other suitable engines up to 93.2 kW (125 hp). Standard total fuel capacity 80 litres (21.1 US gallons; 17.6 Imp gallons) in two tanks in wing leading-edges; can be increased to 130 litres (34.3 US gallons; 28.6 Imp gallons); latter standard for US market. Oil capacity 3 litres (0.8 US gallons; 0.7 Imp gallons).

ACCOMMODATION: Gull-wing door on each side of cabin.

DIMENSIONS, EXTERNAL:

Wing span	9.18 m (30 ft 1 1/2 in)
Length overall	7.08 m (23 ft 2 3/4 in)
Height overall	2.14 m (7 ft 0 1/4 in)

DIMENSIONS, INTERNAL:

Cabin max width	1.16 m (3 ft 9 3/4 in)
-----------------	------------------------

AREAS:

Wings, gross	12.48 m ² (155.9 sq ft)
--------------	------------------------------------

WEIGHTS AND LOADINGS:

Weight empty	290 kg (639 lb) ¹
Max T-O weight	450 kg (992 lb) ¹
where allowed	599 kg (1,320 lb)

¹ if flown as ultralight

PERFORMANCE (Rally 105 UL):

Max level speed	130 kt (240 km/h; 149 mph)
Cruising speed at 75% power	116 kt (215 km/h; 134 mph)
Stalling speed: flaps up	44 kt (82 km/h; 51 mph)
flaps down	35 kt (65 km/h; 41 mph)
Max rate of climb at S/L	390 m (1,280 ft)/min
Service ceiling	3,657 m (12,000 ft)
T-O run	110 m (360 ft)
Landing run	137 m (450 ft)
Max range	809 n miles (1,500 km; 932 miles)
g limits	+4.5/-2.2

TECNAM

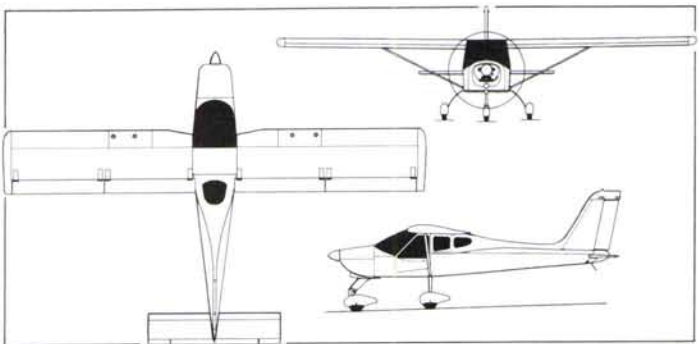
COSTRUZIONI AERONAUTICHE TECNAM SRL

Ia Traversa Via G Pascoli, I-80026 Casoria (Naples)
Tel: (+39 081) 758 32 10 and 758 87 51
Fax: (+39 081) 758 45 28
e-mail: tecnamca@tin.it
Web: www.tecnam.com
MANAGING DIRECTOR: Prof Luigi Pascale Langer
MARKETING AND SALES DIRECTOR: Paolo Pascale Langer

Company founded 1986, after Pascale brothers were released from the original Pascale company, Partenavia (see now VulcanAir), which had been placed under control of Alenia in 1981. Tecnam manufactures tailplane and other components of ATR 42/72 and parts of A 109, C-27J, SF-260, P.68, plus fuselage panels for Boeing. Workshops qualified to NATO AQAP4 and to Italian Aeronautical Register, JAR 21/F. Manufactures P92 Echo ultralight aircraft and P92-J very light aircraft and in 1997 launched production of the P96 and P96-J; P92 SeaSky amphibian added to range in 1998, P92-S in 1999, 2000 RG in 2000, Sierra in 2003 and P2004 Bravo in 2004. First twin was P2006T, announced in early 2006. Pacific Aerosystem of San Diego appointed US agents in 2001.
By June 2005, had produced more than 1,300 kits and complete aircraft.
The company operates from an 11,000 m² (118,400 sq ft) facility at Napoli-Capodichino.

TECNAM P92 ECHO

TYPE: Side-by-side lightplane/kitbuilt.
PROGRAMME: First flight 14 March 1993. Prototype P92-J (I-TECN) first flown second quarter 1995 and received type certificate 10 November 1995. Production rate 10 per month by end 2001.
CURRENT VERSIONS: **P92:** Standard ultralight version (Italian ULM rules).
P92-J: Detail differences in airframe and equipment to comply with JAR-VLA airworthiness requirements. First delivery (002), to US distributor, second quarter 1996; 12 built by 1998; manufacture suspended until 2001, when replaced by upgraded P92-JS.
P92-JS: Upgraded, certified, version of P-92J with higher-powered Rotax 912 ULS and slightly higher max T-O weight plus increased fuel capacity.
P92-S and P92-ES Echo Super: Added to range in 1999; redesigned rear cabin with additional window; redesigned wing profile and wingtips, revised engine cowl and windscreen; improvements in performance. Jabiru-engined ultralight version is **P92-EM**. As described.
P92-ES Echo Super LSA: Approved for US LSA category; MTOW 598 kg (1,320 lb). Basic cost (2006) USD80,900.
P92 Echo Short-Wing: Version for German market with lower empty weight of 275 kg (606 lb), max T-O weight 550 kg (1,212 lb). Bulged cockpit doors, but only one rear quarterlight each side.
P92 Echo 2000 RG: Retractable landing gear version introduced in 2000. Similar to P92-S, but with shorter (8.70 m; 28 ft 6½ in) wing span and reprofiled flaps and fin tips. Fuselage lower surfaces redesigned (rounded and deeper) to accommodate retracted gear; bulged doors provide extra 4 cm (1½ in) of shoulder room.
P92 SeaSky: Amphibious floatplane version first flown 1 July 1997; strake below rear fuselage. Full Lotus floats with optional wheels for land operations, Rotax 912 ULS engine and increased empty and maximum T-O weights.
Echo 80: Either P92 or P92-S available with standard Rotax 912 UL engine.
Echo 100S: Either P92 or P92-S available with optional Rotax 912 ULS engine. Latter variant designated P92 Echo S 100S.
CUSTOMERS: Some 960 of all versions delivered by mid-2006; six to Cambodian Air Force (first two September 1994); overseas orders currently account for 51 per cent of production, including many to Israel. P92-J and -JS deliveries totalled 47 by mid-2005. P92 2000 RG deliveries totalled 45 by October 2004.
COSTS: P92 Echo EUR57,400 with Rotax 912UL, EUR59,300 with Rotax 912ULS; P92-JS EUR95,900 certified; P92-S EUR62,600 with Rotax 912UL; EUR64,500 with Rotax 912ULS; P92-ES EUR64,800 with Rotax 912, EUR69,800 with Rotax 912ULS; P92 2000RG EUR71,700 (all less taxes, 2005).
DESIGN FEATURES: Objectives were lightness, simplicity and accessibility for inspection and servicing. Braced single-spar high wing; aerofoil chosen for good performance at low Reynolds number; untapered with 1° 30' dihedral; underside of fuselage mostly flat for ease of kit assembly; large one-piece windscreen, inward-tapered inboard wing leading-edges, large windows in doors; rear view window(s).



Tecnam P92-J two-seat ultralight (Paul Jackson)

1158031

FLYING CONTROLS: Manual. Frise ailerons; all-moving tailplane with anti-balance tab; electrically actuated flaps cover half trailing-edge.
STRUCTURE: Fuselage mainly metal except GFRP lower shell of engine cowl and wing leading-edge; ailerons and part of tailplane fabric covered; GFRP rudder tip; tailplane halves can be unpinned and removed quickly for transport; engine cowl removable by undoing four quick latches to reveal whole power plant.
LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring steel cantilever mainwheel legs with wheel fairings; hand-powered hydraulic disc brakes operated together from single lever in cockpit; nosewheel, with compressed rubber shock absorber, steered from rudder pedals; designed for grass field operation. Wheels 5.00-5 on P92-S and P92-JS; with option to increase to 6.00-6; 400-6 on SeaSky. P92 2000 RG nosewheel is 11x4.00, has oleo-pneumatic shock-absorber and retracts rearwards; 14x4 mainwheels retract inward. Both tube legs are mounted on a single cantilever arm.
POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL (P92) or 912A (P92-J) or 73.5 kW (98.6 hp) Rotax 912 ULS flat-four engine; integrated reduction gear driving two-blade wooden propeller: GT-166/146 for Rotax 912 UL; GT-172/164 for Rotax 912 ULS landplane; GT-182/118 for SeaSky.
Limbach 2000 (59.7 kW; 80 hp) and Rotax 582 (47.8 kW; 64.1 hp) two-stroke offered as options for P92; P92 prototype had the latter; 59.7 kW (80 hp) Jabiru 2200 flat-four available from 2000.
P92 Echo Short-Wing has 59.7 kW (80 hp) Jabiru 2200 as standard, with options to fit 59.6 kW (79.9 hp) Rotax 912 UL or 73.5 kW (98.6 hp) Rotax 912 ULS.
Fuel capacity 70 litres (18.5 US gallons; 15.4 Imp gallons) in two wing tanks, of which 60 litres (15.9 US gallons; 13.2 Imp gallons) are usable.
P92-JS fuel capacity 90 litres (23.8 US gallons; 19.8 Imp gallons).
ACCOMMODATION: Side-by-side seats with three-point harness; baggage space behind seats. Full dual controls and two throttles. Bulged doors on current versions give increased cabin width.
SYSTEMS: 14 V 55 A battery; 100 W alternator. Optional BRS-5 parachute in P92 2000 RG.
AVIONICS: Customer specified; optional IFR nav/com in P92-J.
DIMENSIONS, EXTERNAL (all versions, except where indicated):
Wing span: P92 2000 RG, P92-JS 8.70 m (28 ft 6½ in)
P92, P92-S 9.30 m (30 ft 6 in)
P92-J, SeaSky 9.60 m (31 ft 6 in)
Wing chord, constant portion 1.40 m (4 ft 7 in)
Length overall: except P92 2000 RG 6.30 m (20 ft 8 in)
P92 2000 RG 6.40 m (21 ft 0 in)
Height overall: except SeaSky 2.49 m (8 ft 2 in)
SeaSky 2.97 m (9 ft 9 in)
Tailplane span 2.90 m (9 ft 6 in)
Wheel track:
except SeaSky, P92 2000 RG, P92-JS 1.78 m (5 ft 10 in)
P92 2000 RG 1.73 m (5 ft 8 in)
P92-JS 1.80 m (5 ft 11 in)
Float track: SeaSky 2.79 m (9 ft 2 in)
Propeller diameter: 59.7 kW engine 1.66 m (5 ft 5¼ in)
73.5 kW engine 1.72 m (5 ft 7¾ in)
DIMENSIONS, INTERNAL:
Cabin max width 1.14 m (3 ft 9 in)



US LSA version of Tecnam P92-ES Echo Super (Paul Jackson)

1158010

AREAS:	
Wings, gross:	
P92, P92-J, P92-S	13.20 m ² (142.1 sq ft)
P92 2000 RG, P92-ES	11.98 m ² (129.0 sq ft)
SeaSky	13.40 m ² (144.2 sq ft)
Tailplane	1.97 m ² (21.20 sq ft)
WEIGHTS AND LOADINGS:	
Basic weight empty:	
P92, P92-S, P92 2000 RG	281 kg (619 lb)
P92-J	305 kg (672 lb)
P92-JS	310 kg (683 lb)
SeaSky	330 kg (728 lb)
LSA	331 kg (730 lb)
Max T-O weight:	
ultralight: P92, P92-S, P92 2000 RG	450 kg (992 lb)
SeaSky	500 kg (1,102 lb)
certified: P-92, P92-S, P92-JS	550 kg (1,212 lb)
P92-J	520 kg (1,146 lb)
SeaSky	600 kg (1,322 lb)
LSA	598 kg (1,320 lb)
PERFORMANCE, POWERED (P92 in Echo 80 form, P92-S in Echo 100 form, LSA in P92-ES form):	
Never-exceed speed (VNE):	
except SeaSky and P92-JS	135 kt (250 km/h; 155 mph)
P92-JS	145 kt (270 km/h; 167 mph)
SeaSky	108 kt (200 km/h; 124 mph)
LSA	132 kt (244 km/h; 151 mph)
Max level speed at S/L:	
P92, P92-JS	119 kt (220 km/h; 137 mph)
P92-S	124 kt (230 km/h; 143 mph)
P92-J	110 kt (204 km/h; 127 mph)
P92 2000RG	135 kt (250 km/h; 155 mph)
SeaSky	92 kt (170 km/h; 106 mph)
LSA	118 kt (219 km/h; 136 mph)
Cruising speed at 75% power:	
P92 2000 RG	124 kt (230 km/h; 143 mph)
P92, P92-J, P92-JS	100 kt (185 km/h; 115 mph)
P92-S	105 kt (195 km/h; 121 mph)
SeaSky	84 kt (156 km/h; 97 mph)
LSA	112 kt (207 km/h; 129 mph)
Stalling speed:	
flaps up: P92	36 kt (68 km/h; 42 mph)
P92-J	40 kt (74 km/h; 46 mph)
LSA	45 kt (84 km/h; 52 mph)
flaps down:	
P92, P92-S, P92 2000 RG	33 kt (61 km/h; 38 mph)
P92-J, SeaSky	35 kt (64 km/h; 40 mph)
P92-JS	36 kt (67 km/h; 42 mph)
LSA	37 kt (69 km/h; 43 mph)
Max rate of climb at S/L: P92	
P92-J	330 m (1,082 ft)/min
P92-S	262 m (860 ft)/min
P92-JS	360 m (1,180 ft)/min
P92-S, P92 2000 RG	384 m (1,260 ft)/min
SeaSky	244 m (800 ft)/min
LSA	325 m (1,067 ft)/min
Service ceiling: P92, P92-JS	
P92 2000 RG, P92-S	4,265 m (14,000 ft)
P92-J	4,510 m (14,800 ft)
P92-S	4,115 m (13,500 ft)
SeaSky	3,505 m (11,500 ft)
LSA	3,990 m (13,100 ft)
T-O run:	
on land: P92	110 m (360 ft)
P92-J	122 m (400 ft)
P92-JS	143 m (470 ft)
P92-S	100 m (330 ft)
P92 2000 RG	140 m (460 ft)
SeaSky	122 m (400 ft)
LSA	186 m (610 ft)
on water: SeaSky	350 m (1,150 ft)
Landing run:	
on land:	
P92, P92-S, P92-ES	100 m (328 ft)
P92 2000 RG	110 m (360 ft)
P92-J	92 m (300 ft)
SeaSky	122 m (400 ft)
LSA	150 m (490 ft)
on water (SeaSky)	350 m (1,150 ft)
Max range, no reserves:	
except SeaSky and P92-JS	400 n miles (740 km; 460 miles)
P92-JS	450 n miles (833 km; 517 miles)
SeaSky	300 n miles (555 km; 345 miles)
Endurance: P92	
P92-J	4 h 30 min
P92-JS	5 h
g limits: P92-J, P-92-S, LSA	
P92-JS	+6/-3
SeaSky	+3.8/-1.5
SeaSky	+5.3/-2
PERFORMANCE, UNPOWERED:	
Best glide ratio: P92, P92-J	13

TECNAM P96 GOLF

TYPE: Side-by-side ultralight.
PROGRAMME: Prototype construction began July 1996; first flight March 1997, Uprated Golf 100 added in 1999. Replaced by P2002 Sierra, although promotion was continuing in 2006.
CURRENT VERSIONS: **P96 Golf 80:** Ultralight version.
P96 Golf 100: Higher-powered ultralight version.
CUSTOMERS: The 200th Golf registered in Canada (C-ITEC) in February 2002; by October 2004 this had risen to 267, but none further reported by mid-2006.
COSTS: Kit EUR67,900 excluding tax (2005).



Tecnam P96 Golf 100 (Paul Jackson)

1158011

TECNAM P2002 SIERRA

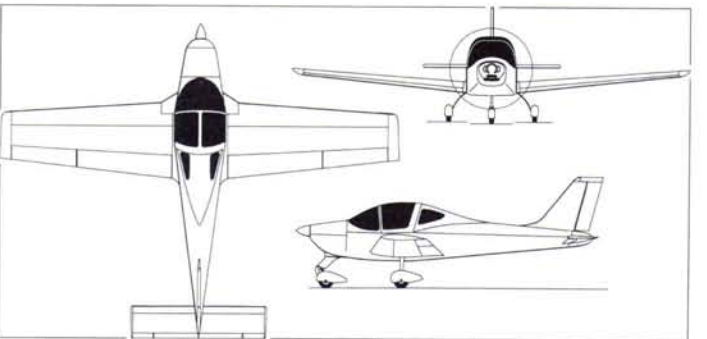
TYPE: Side-by-side lightplane/kitbuilt.
PROGRAMME: First publicly displayed (I-TEJF) at Aero '03, Friedrichshafen, April 2003. EASA certification awarded 27 May 2004 as P2002-JF; Australian certification 16 November 2004.
CURRENT VERSIONS: **P2002:** Standard ultralight version.
P2002-JF: Certified version for German and Australian markets; *as described*.
P2002 LSA: Approved for US LSA category; MTOW 598 kg (1,320 lb). Basic price USD86,900 (2006).
P2002-JR: Certified version. Prototype (I-TEJR) shown at Aero '05, Friedrichshafen, April 2005. Retractable landing gear; mainwheels retract outwards, having trailing link suspension with compressed rubber shock absorbers; nosewheel retracts rearward on oleo leg.
CUSTOMERS: Total of 180 kits produced by April 2006 for customers in Australia, Austria, Brazil, Canada, Czech Republic, France, New Zealand, South Africa, Spain, Switzerland, US and elsewhere. Chosen by Basair as a Cessna 152 replacement in May 2005.
COSTS: P2002 EUR74,200. P2002-JF ready-to-fly EUR101,450, both excluding tax (2005).
DESIGN FEATURES: Considerably upgraded Tecnam P96 Golf to meet EASA certification standards.
FLYING CONTROLS: As P96. Control surface movements: ailerons +20/-15°; tailplane +15/-3°; rudder ±30°; flaps 0, 15 and 40°.
STRUCTURE: Redesigned fuselage with reprofiled cabin area. New all-metal tapered wing (ratio 0.6) has 5° dihedral and upturned tips.
LANDING GEAR: As P96 Golf, Cleveland wheels and brakes.
POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912S-2 with 1:2.42 reduction gear driving a Hoffmann HO-17-GHMA-174-177C (as certified), GT Propellers GT-2/173/VRR-FW101SRTC or similar two-blade, fixed-pitch propeller. Fuel in two wing tanks; total capacity 100 litres (26.4 US gallons; 22.0 Imp gallons) of which 99 litres (26.1 US gallons; 21.8 Imp gallons) usable. Optional P96 Golf fuel tanks of reduced capacity.
ACCOMMODATION: Two seats side by side. Canopy slides rearwards and can be opened with engine on and during flight.
SYSTEMS: 12 V 18 Ah battery, 200 W alternator.
AVIONICS: Bendix/King or Garmin equipment, to customer's choice.
Comms: KX 155 nav/com or ICOM-IC-A200 VHF, KT 76A, GTX 320 or GTX 327 transponder.
Flight: GNS 430 GPS/NAV receiver.
Instrumentation: KI 208 or GI 106A VOR/LOC.

DIMENSIONS, EXTERNAL:	
Wing span	8.60 m (28 ft 2½ in)
Wing aspect ratio	6.4
Length overall	6.61 m (21 ft 8¼ in)
Height overall	2.43 m (7 ft 11½ in)
Tailplane span	2.90 m (9 ft 6¼ in)
Wheel track	1.85 m (6 ft 0¾ in)
Wheelbase	1.62 m (5 ft 3¾ in)
Propeller diameter	1.74 m (5 ft 8½ in)
DIMENSIONS, INTERNAL:	
Cabin max width	1.10 m (3 ft 7¼ in)



Tecnam P2002 Sierra operated in US LSA category (Paul Jackson)

1158013



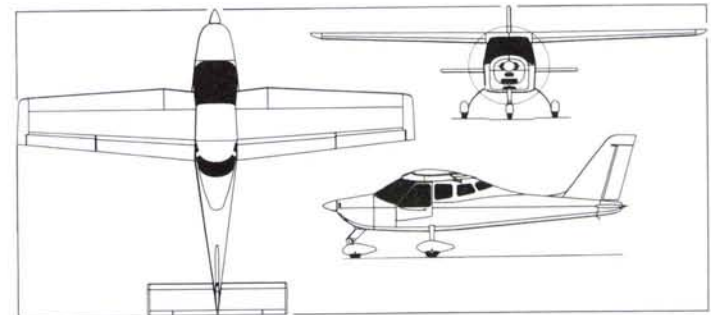
Tecnam P2002 Sierra (Paul Jackson)

1127531

AREAS:	
Wings, gross	11.50 m ² (123.8 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty: P2002	337 kg (743 lb)
LSA	331 kg (730 lb)
Max baggage weight	20 kg (44 lb)
Max T-O weight: P2002	580 kg (1,279 lb)
LSA	598 kg (1,320 lb)
Max wing loading: P2002	50.4 kg/m ² (10.33 lb/sq ft)
LSA	52.06 kg/m ² (10.66 lb/sq ft)
Max power loading: P2002	7.90 kg/kW (12.97 lb/hp)
LSA	8.15 kg/kW (13.39 lb/hp)
PERFORMANCE (LSA):	
Never-exceed speed (VNE)	135 kt (250 km/h; 155 mph)
Max level speed	120 kt (222 km/h; 138 mph)
Cruising speed at 75% power	116 kt (215 km/h; 133 mph)
Stalling speed, power off: flaps up	45 kt (84 km/h; 52 mph)
flaps down	38 kt (71 km/h; 44 mph)
Max rate of climb at S/L	372 m (1,220 ft)/min
Service ceiling	3,995 m (13,110 ft)
T-O run	232 m (762 ft)
Landing run	186 m (610 ft)
Range at cruising speed	590 n miles (1,092 km; 679 miles)
g limits	+6/-3

TECNAM P2004 BRAVO

TYPE: Side-by-side lightplane/kitbuilt.
PROGRAMME: High-wing version of Tecnam P2002 Sierra; first flight 9 September 2004.
Description generally as for P2002 Sierra. Differences include:
CURRENT VERSIONS: **P2004 Bravo**: Baseline version. As described.
P2004 Bravo LSA: US LSA category; MTOW 598 kg (1,320 lb).
CUSTOMERS: Total 54 kits produced by April 2006 for customers in Canada, New Zealand, US and elsewhere.
COSTS: USD84,900 basically equipped, LSA (2006).
DESIGN FEATURES: Wing dihedral 1° 30'.
POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS flat four driving a Tonini two-blade propeller via a 2.4286:1 reduction gear.
DIMENSIONS, EXTERNAL:
Wing span 8.40 m (27 ft 6¾ in)
Length overall 6.61 m (21 ft 8¼ in)
Height overall 2.60 m (8 ft 6¼ in)
Tailplane span 2.90 m (9 ft 6¼ in)
Wheel track 1.85 m (6 ft 0¾ in)
DIMENSIONS, INTERNAL:
Cabin max width 1.15 m (3 ft 9¼ in)
AREAS:
Wings, gross 11.00 m² (118.4 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 283 kg (624 lb)

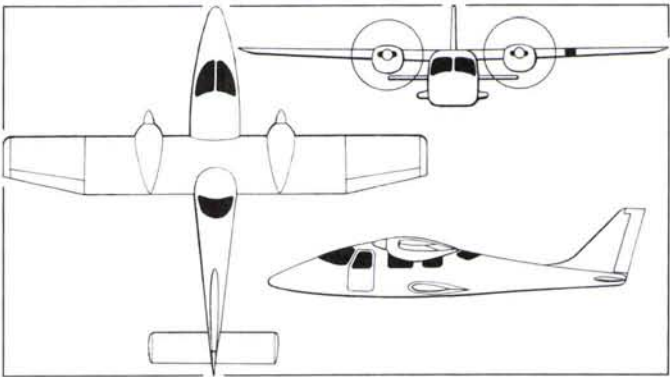


Tecnam P2004 Bravo (Paul Jackson) 1127530

PERFORMANCE:	
Never-exceed speed (VNE): P2002	157 kt (290 km/h; 180 mph)
LSA	135 kt (250 km/h; 155 mph)
Max level speed at S/L: P2002	129 kt (238 km/h; 148 mph)
LSA	120 kt (222 km/h; 138 mph)
Cruising speed at 75% power	116 kt (215 km/h; 134 mph)
Stalling speed: flaps up, LSA	46 kt (84 km/h; 53 mph)
flaps down: P2002	35 kt (64 km/h; 40 mph)
LSA	39 kt (71 km/h; 45 mph)
Max rate of climb at S/L	360 m (1,181 ft)/min
Service ceiling	4,270 m (14,000 ft)
T-O run	140 m (460 ft)
Landing run	120 m (394 ft)
Range at cruising speed, LSA	589 n miles (1,092 km; 678 miles)

TECNAM P2006T

TYPE: Four-seat utility twin.
PROGRAMME: Announced early 2006.
COSTS: EUR235,000 (2006).
DESIGN FEATURES: High-wing (twin-prop); straight wing leading edge with constant-chord centre section and forward sweep on outer panels; sweptback fin with low, constant-chord tailplane.
Wing section NACA 63A.
FLYING CONTROLS: Manual. All-moving, low-mounted tailplane with anti-balance tab; Frise ailerons; rudder with electronic trim tab. Slotted flaps, electrically actuated.
STRUCTURE: Generally of aluminium alloy. Single-spar wing.
LANDING GEAR: Tricycle type; retractable. Trailing-link, aluminium main gear legs attached to fuselage bulkhead and fitted with oleo-pneumatic shock absorbers; electro-hydraulic inboard retraction, turning through 90°; retracted mechanism partly covered by fairings scabbled to fuselage sides. Cleveland mainwheels and hydraulic brakes; 6.00-6 tyres. Oleo-pneumatic, telescoping, steerable nosewheel leg braced to forward bulkhead by steel truss; 5.00-5 tyre. Gravity-actuated backup deployment system.
POWER PLANT: Two 73.5 kW (98.6 hp) Rotax 912S liquid-cooled, flat-fours driving Hoffmann HO-V352 two-blade, constant-speed, feathering propellers via 2.4286:1 reduction gear. Fuel tanks in wings, outboard of engines; combined capacity 200 litres (52.8 US gallons; 44.0 Imp gallons), of which 190 litres (50.2 US gallons; 41.8 Imp gallons) usable.
ACCOMMODATION: Four persons in two side-by-side pairs. Door each side: left, front for flight crew; right, rear for passengers. Windscreen: door windows; two windows each side, rear of doors; and rear-facing window. Cabin crashworthiness to FAR Pt 23/EASA CS23 standards. Dual controls. Accommodation heated and ventilated. Baggage compartment with external door.
SYSTEMS: Electrical system includes two 12 V 21 A alternators and Gill 35 Ah battery.
AVIONICS: Standard equipment generally by Garmin.
Comms: GNS 430 COM/NAV/GPS; GTX 327 transponder; GMA 430 audio panel. Optional second GNS 430 and substitute GTX 330 Mode S transponder and substitute GNS 530 panel.
Flight: Optional S-Tec 55X dual-axis autopilot and ST-360 altitude selector with ST-361 flight director; Bendix/King KCS 55A HSI, KR 87/KI 227 ADF and KN 63 DME.



Provisional general arrangement of Tecnam P2006T (James Goulding) 1159812



US Light Sport (LSA) version of Tecnam P2004 Bravo (Paul Jackson) 1158016



Artist's impression of Tecnam P2006T project

1158019



Optional EFIS cockpit offered for Tecnam P2006

1158020



Standard instrument panel for Tecnam P2006T

1158021



Full IFR analogue panel option for Tecnam P2006T

1158022

Instrumentation: GI 106 indicator. Optional Pegasus EFIS with two 264 mm (10.4 in) PFD/MFD screens incorporating AHRS, ADC, EICAS, dual mav/com, GPS, Mode S and digital audio panel.

EQUIPMENT: Navigation and landing/taxi lights.

DIMENSIONS, EXTERNAL:

Wing span	10.60 m (34 ft 9 1/4 in)
Wing aspect ratio	7.8
Length overall	8.66 m (28 ft 5 in)
Height overall	2.85 m (9 ft 4 1/4 in)

VULCANAIR

VULCANAIR SPA

Capodochino East Plant, Via G Pascoli 7, I-80026 Casoria (NA)

Tel: (+39 081) 591 81 11

Fax: (+39 081) 591 81 72

e-mail: marketing&sales@vulcanair.com

Web: www.vulcanair.com

PRESIDENT: Carlo de Feo

MARKETING MANAGER: Gianni de Stefano

DIRECTOR OF SALES: Remo de Feo

US MARKETING OFFICE:

VulcanAir Inc

1101 30th Street, NW, Suite 50, Washington, DC 20007, USA

Tel: (+1 202) 625 43 47

Fax: (+1 202) 625 43 63

e-mail: sales@vulcanair-usa.com

Web: www.vulcanair-usa.com

Samanta aircraft service company purchased by Carlo de Feo in 1997; Samanta renamed as VulcanAir in April 1998 when it purchased bankrupt Partenavia company. VulcanAir returned P.68 series to production in 1999 and continues to supply spares for Partenavia aircraft. Acquired rights to SF.600 Canguro from SIAI-Marchetti on latter's incorporation into Aermacchi in 1997. In June 1999, VulcanAir announced development of the VA 300 twin-diesel-engined light transport derivative of the P.68 and single-engined VF 600W Mission, the latter a new aircraft with some commonality with the SF.600A and P.68 series.

Workforce 160 in 2004; 60,000 m² (645,834 sq ft) production facility at Naples-Capodochino Airport.

At the Dubai Air Show in November 2005, Vulcanair announced plans for an updated version of the former Partenavia AP.68TP 600 Viator twin-turboprop 11-seat utility aircraft, of which six examples were built by Partenavia before Vulcanair acquired the company. The new version would incorporate airframe and systems upgrades including a new avionics suite in a 'glass' cockpit. A new prototype Viator was under construction in late 2005, and subject to proof-of-concept and market studies, production could resume during 2006 if sufficient

Propeller diameter	1.72 m (5 ft 7 3/4 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	2.50 m (8 ft 2 1/2 in)
Max width	1.14 m (3 ft 9 in)
Baggage compartment volume	0.35 m ³ (12.4 cu ft)
AREAS:	
Wings, gross	14.40 m ² (155.0 sq ft)
WEIGHTS AND LOADINGS (estimated):	
Weight empty	640 kg (1,411 lb)
Max baggage weight	60 kg (132 lb)
Max T-O weight	1,100 kg (2,425 lb)
Max wing loading	76.4 kg/m ² (15.65 lb/sq ft)
Max power loading	7.48 kg/kW (12.30 lb/hp)
PERFORMANCE (estimated):	
Max level speed at S/L	153 kt (283 km/h; 176 mph)
Cruising speed: at 75% power	147 kt (272 km/h; 169 mph)
at 65% power	141 kt (261 km/h; 162 mph)
Stalling speed: flaps up	54 kt (100 km/h; 63 mph)
flaps down	48 kt (89 km/h; 56 mph)
Max rate of climb at S/L	415 m (1,361 ft)/min
Service ceiling	4,875 m (16,000 ft)
Service ceiling, OEI	2,040 m (6,700 ft)
T-O run	225 m (740 ft)
T-O to 15 m (50 ft)	420 m (1,380 ft)
Landing from 15 m (50 ft)	340 m (1,115 ft)
Landing run	180 m (590 ft)
Range with 30 min reserves:	
75% power	685 n miles (1,268 km; 788 miles)
65% power	710 n miles (1,314 km; 817 miles)

customer demand is established. The Viator was last described in the 2001-02 edition of *Jane's All the World's Aircraft*.

VULCANAIR P.68

TYPE: Light utility twin-prop transport; multisensor surveillance twin-prop.

PROGRAMME: Prototype (I-TWIN) first flew 25 May 1970. Production of P.68 Victor and P.68B by Partenavia in Italy started 1978, followed by P.68C in 1980. Partenavia manufacture ended in 1994, but assets subsequently acquired by VulcanAir; 10 assembled in India up to 1999 by TAAL. Improvements announced in 1999 included Garmin avionics.

CURRENT VERSIONS: **P.68C:** Basic version, as described.

P.68C TC: As P.68C, but with turbocharged engines for better hot-and-high performance.

P.68C Jet: As P.68C, but with SMA SR305. Diesel engines. Engine runs under way by February 2004, first flight (I-DJET, c/n 426) 24 February 2005. EASA certification was then expected in second quarter of 2005, but had not been received a year later.

P.68 Observer 2: For use by government and specialised services for patrol, surveillance and search; largely transparent nose section with lowered, compact instrument panel; 63 × 46 cm (2 ft 1 in × 1 ft 6 in) underfuselage hatch can carry variety of electro-optical sensors; slightly different equipment from other versions.

P.68 Observer Jet: As P.68 Observer 2, but with SMA SR305 Diesel engines.

P.68 TC Observer TC: Turbocharged version of Observer 2 for hot/high performance.

CUSTOMERS: Total 401 P.68s of all versions built in Italy by end 1998; these comprised 12 P.68s, 196 P.68Bs, 91 P.68Cs, 47 P.68C TCs, 39 Observers, seven Observer 2s, three Observer TCs and six untraced. VulcanAir began production batch of 20 (mainly Observer 2s) in 1998, these all complete by end of 2003. Eight Observer 2s sold to Italian police; first delivery (PS-B07) 11 November 1999. Further four (including three Observer 2s) registered in USA 2000-02, excluding demonstrator; others to Germany (two), Spain (three) and Italy (two) in 2003. Total of some 430 P.68s, including 26 Observer 2s built in Italy by late 2005. Also built in India by Taneja Aerospace, although this manufacture not approved by Vulcanair: 10 (nine P.68Cs and one Observer) between 1995 and 2001, plus further two P.68Cs in 2006.

COSTS: USD475,000 (P.68C); USD485,000 (P.68 Observer 2); USD505,000 (P.68C-TC); USD515,000 (P.68 TC Observer), all IFR equipped (2001).

DESIGN FEATURES: High wing with NACA 63-3515 aerofoil section and Hoerner tips; dihedral 1°, incidence 1° 3'.



Australian registered Vulcanair P.68C

FLYING CONTROLS: Manual. Pushrod and cable actuated, with all-moving tailplane and anti-balance tab; trim tab in rudder; electrically operated single-slotted flaps.

STRUCTURE: Light alloy stressed skin fuselage with frames and longerons; stressed skin two-spar torsion box wing; metal stressed skin tailplane and fin; fuselage/wing fairings mainly GFRP.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring steel cantilever mainwheel legs; oleo suspension for nosewheel, steered from rudder pedals. Mainwheels Cleveland 40-142 with Goodyear 7.00-6 (8 ply) tyres; nosewheel Cleveland 40-77B with Goodyear 5.00-5 (6 ply) tyre 6.00-6 (8 ply) tyre optional; Cleveland Type 30-61 foot actuated heavy duty hydraulic disc brakes; streamlined wheel fairings optional. P.68 Observer 2 has larger mainwheel tyres as standard. Minimum ground turning radius 5.70 m (18 ft 8 in).

POWER PLANT: P.68C: Two 149 kW (200 hp) Textron Lycoming IO-360-A1B6 flat-four engines, each driving a Hartzell HC-C2YK-2CUF two-blade constant-speed fully feathering propeller. Fuel capacity 696 litres (184 US gallons; 153 Imp gallons) in integral wing tanks, of which 670 litres (177 US gallons; 147 Imp gallons) usable.

P.68C TC: Two 157 kW (210 hp) Textron Lycoming TIO-360-C1A6D: same propellers as P.68C.

P.68C Jet and P.68 Observer Jet: Two 171.5 kW (230 hp) Snecma-Renault SR305-230 turbocharged flat-four diesel engines.

Usable fuel capacity 520 litres (137 US gallons; 114 Imp gallons) in integral wing tank; overwing gravity refuelling. Oil capacity 7.5 litres (2.0 US gallons; 1.7 Imp gallons) for each engine.

ACCOMMODATION: One or two pilots and five or six passengers; cabin has two forward-facing seats in middle and three-seat rear bench; club seating optional; baggage door at rear and pilot door at front on starboard side; passenger door to port in centre cabin; escape hatch on starboard side; baggage compartment accessible from inside cabin. P.68 Observer 2 has no front starboard door for pilots. Optional aerophotogrammetric floor hatch, 0.63 x 0.46 m (2 ft 0 1/4 in x 1 ft 6 in) on P.68C.

SYSTEMS: Two 28 V 130 Ah alternators and one 24 V 24 Ah battery; Goodrich pneumatic de-icing boots and electro-thermal propeller de-icing optional; air conditioning optional.

AVIONICS: Garmin and Bendix/King avionics package standard.

Comms: GMA 340 audio panel with marker beacon receiver and intercom; GTX 320A transponder; control wheel PTT switch; microphone with headset; speakers with microphone jacks; avionics master switch; ELT 910 automatic ELT, all standard. NAT AMS44TL audio panel optional.

Radar: Bendix/King RDR 2000 vertical profile weather radar optional.

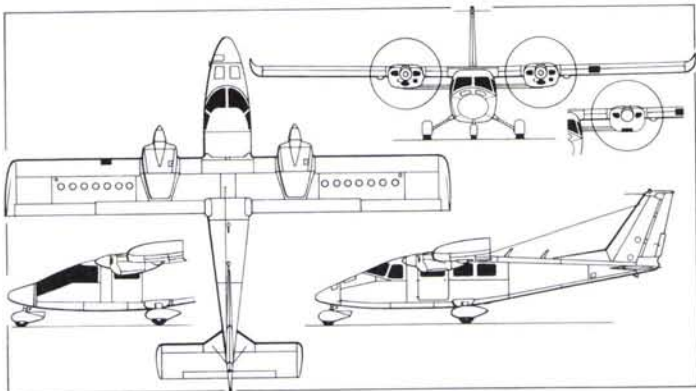
Flight: Dual Garmin GNS 430 com/nav/GS/GPS; Bendix/King KFC 150 two-axis autopilot with CWS instant disconnect; KEA 130 encoding altimeter; dual KI 209A VOR/LOC/GS/GPS indicators; KI 256 ADI; KI 525A HSI; KCS 55 compass, all standard. Options include GNS 530 (exchange for GNS 430); Goodrich WX500 Stormscope; Goodrich Skywatch; Bendix/King KRA 10A radar altimeter; KR 87 digital ADF; KN-62A DME; KI 229 RMI, all standard.

Instrumentation: ASI; VSI; electric turn-and-bank indicator; Vision Microsystems LCD graphic/digital monitoring system; magnetic compass; DVR 300I digital voice recorder/clock; gyro pressure gauge; annunciator panel; engine hours meter, all standard. Optional duplicated co-pilot's instruments comprise sensitive altimeter, ASI, vacuum turn-and-bank indicator, VSI and electric or vacuum attitude gyro indicator.

Mission: Observer 2 can carry FLIR, ATAL video surveillance pod with data downlink and SLAR. Aerial cameras, thermal imager and video camera can be operated through floor hatch.

EQUIPMENT: Standard equipment includes heated pitot and stall warning systems, 24 V 2 A auxiliary power socket, pilot and co-pilot storm windows, polished wing-mounted taxi and

landing lights, wingtip recognition and strobe lights, ice inspection light on port wing, tail recognition and strobe lights, tiedown rings and control surface locks. Leather seats and tinted windows optional.	
DIMENSIONS, EXTERNAL (C: P.68C, D: P.68C Jet and P.68 Observer Jet, TC: P.68C-TC, O: P.68 Observer 2, TCO: P.68 Observer TC):	
Wing span	12.00 m (39 ft 4 1/2 in)
Wing chord, constant	1.55 m (5 ft 1 in)
Wing aspect ratio	7.7
Length overall: C, D, TC	9.55 m (31 ft 4 in)
O, TCO	9.43 m (30 ft 11 1/4 in)
Height overall	3.40 m (11 ft 1 3/4 in)
Tailplane span	3.90 m (12 ft 9 1/2 in)
Wheel track	2.40 m (7 ft 10 1/2 in)
Wheelbase	3.65 m (11 ft 11 3/4 in)
Propeller diameter: all versions	1.83 m (6 ft 0 in)
Propeller ground clearance	0.77 m (2 ft 6 1/4 in)
Passenger doors (C, TC):	
Each Side: max width	0.54 m (1 ft 9 1/4 in)
Port, centre: max width	0.82 m (2 ft 8 1/4 in)
Baggage door, stbd, aft:	
Max height	0.83 m (2 ft 8 3/4 in)
Max width	0.80 m (2 ft 7 1/2 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	4.05 m (13 ft 3 1/2 in)
Max width	1.16 m (3 ft 9 1/2 in)
Max height	1.20 m (3 ft 11 1/4 in)
Baggage compartment volume	0.56 m ³ (19.8 cu ft)
AREAS:	
Wings, gross	18.60 m ² (200.2 sq ft)
Ailerons (total)	1.79 m ² (19.27 sq ft)
Trailing-edge flaps (total)	2.37 m ² (25.51 sq ft)
Fin	1.59 m ² (17.11 sq ft)
Rudder, incl tab	0.44 m ² (4.74 sq ft)
Tailplane, incl tab	4.41 m ² (47.47 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty equipped: C, O	1,320 kg (2,910 lb)
TC, D, TCO	1,350 kg (2,976 lb)
Baggage capacity	181 kg (400 lb)
Max T-O weight	2,084 kg (4,594 lb)
Max ramp weight	2,100 kg (4,630 lb)
Max landing weight	1,980 kg (4,365 lb)
Max zero-fuel weight	1,890 kg (4,167 lb)
Max wing loading	112.0 kg/m ² (22.94 lb/sq ft)
Max power loading	6.99 kg/kW (11.49 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE):	
C, TC	193 kt (358 km/h; 222 mph)
O	194 kt (359 km/h; 223 mph)
Max level speed:	
D at S/L	159 kt (295 km/h; 183 mph)
C, O, TC at S/L	173 kt (320 km/h; 199 mph)
TCO at S/L	174 kt (322 km/h; 200 mph)
Max cruising speed at 75% power:	
D at FL100	170 kt (315 km/h; 196 mph)
C, O at FL75	165 kt (306 km/h; 190 mph)
TC at FL120	170 kt (315 km/h; 196 mph)
TCO	165 kt (306 km/h; 190 mph)
Stalling speed, power off:	
flaps up	68 kt (126 km/h; 79 mph)



VulcanAir P.68C, with scrap view of Observer 2 nose and P.68C Jet engine cowling (Mike Keep)



Prototype P.68C Jet on display at Paris in June 2005 (Paul Jackson)

1127949

flaps down: O	57 kt (106 km/h; 66 mph)
TC	61 kt (113 km/h; 71 mph)
C, TCO	62 kt (115 km/h; 72 mph)
Max rate of climb at S/L: C, O	378 m (1,240 ft)/min
D	457 m (1,500 ft)/min
TC	465 m (1,525 ft)/min
TCO	427 m (1,400 ft)/min
D	530 m (1,740 ft)/min
Rate of climb, OEI: C, O	64 m (210 ft)/min
TCO	73 m (240 ft)/min
TC	88 m (290 ft)/min
D	134 m (440 ft)/min
Service ceiling: C	6,020 m (19,750 ft)
O	6,000 m (19,685 ft)
D, TC, TCO	6,100 m (20,000 ft)
Service ceiling, OEI: C, O	1,753 m (5,750 ft)
TC	4,420 m (14,500 ft)
TCO	3,505 m (11,500 ft)
D	3,660 m (12,000 ft)
T-O run: C, O	240 m (790 ft)
TC, TCO	230 m (755 ft)
T-O to 15 m (50 ft): C, O	400 m (1,312 ft)
TC	384 m (1,260 ft)
TCO	415 m (1,362 ft)
Landing from 15 m (50 ft): C, O	600 m (1,970 ft)
TC	500 m (1,640 ft)
TCO	485 m (1,591 ft)
Landing run: all	200 m (656 ft)
Range with max payload:	
TC	300 n miles (556 km; 345 miles)
O with auxiliary fuel	590 n miles (1,093 km; 679 miles)
Range with max fuel, best economy power:	
D at FL70	1,513 n miles (2,802 km; 2,003 miles)
C, O at FL70	1,601 n miles (2,965 km; 1,842 miles)
TCO at FL100	1,376 n miles (2,550 km; 1,584 miles)
TC at FL100	1,104 n miles (2,046 km; 1,271 miles)
Endurance with max fuel: C, TC, O	11 h
D	12 h 18 min
g limits: C, O	+3.74/-1.50
TC, TCO	+3.80/-1.52

VULCANAIR VF 600w MISSION

TYPE: Light utility turboprop.

PROGRAMME: Launched (as VF 600w) 1999; construction of first prototype began May 2001, at which time first flight planned for following September, but not achieved until 30 January 2003 (following roll-out on 31 May 2002 and first ‘hop’ on 4 December 2002); public debut (I-VAVF) at Paris Air Show 14 June 2003. Total of 88 flight hours recorded by June 2004, when the aircraft was grounded for modifications including a forward crew door and an aft passenger door on the starboard side, and an enlarged cargo door on the port side. Second prototype and one static test airframe then under construction, with maiden flight of second prototype scheduled for October 2004, and EASA certification expected in March 2005, followed by FAA approval about two months later.

Company subsequently announced indeterminate delay; by mid-2006, second aircraft had not flown, although promotion was continuing.

CUSTOMERS: Aimed at cargo/feeder market, law enforcement/security agencies, medevac surveillance, paratrooping and military logistics support. Order book scheduled to open in February 2005.

COSTS: Unit cost approximately US\$1.2 million (2004). Estimated direct operating cost, based on utilisation of 1,000 hours per year, US\$354.32 (2004).

DESIGN FEATURES: Single-engine derivative of Cangaro, Nose-mounted engine; longer-span wings with new (modified NACA 63A3.515) aerofoil section; modified landing gear.

Following details summarise main differences from SF.600A.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring cantilever mainwheel legs; single mainwheels, with size 8.50-10 tyres, pressure 3.79 bar (55 lb/sq in); nosewheel type 6.50-8, pressure 5.17 bar (75 lb/sq in). Cleveland mainwheel disc brakes. Seaplane version being studied.

POWER PLANT: One 580 kW (778 shp) Walter M 601F-11 turboprop, driving an Avia V 510 five-blade constant-speed feathering and reversing metal propeller. Optional Pratt & Whitney Canada PT6A turboprop installation. Alternative power plants may be offered according to market requirements. Fuel capacity (two wing tanks plus reservoir) 1,338 litres (353 US gallons; 294 Imp gallons), of which 1,300 litres (343 US gallons; 286 Imp gallons) are usable.

ACCOMMODATION: Pilot and up to 10 passengers, or up to 15 passengers where local certification criteria permit. In cargo configuration the cabin can accommodate up to three standard Euro pallets. Quick-change cargo loading system with roller tracks, ball plates and latches optional. Pilot’s door on port side; cargo/passenger sliding door on port side.

AVIONICS: Bendix/King avionics suite standard, three-tube EFIS optional.

Comms: Bendix/King COM/NAV/GS/GPS, audio panel with marker beacon receiver and intercom, transponder, ELT 910.

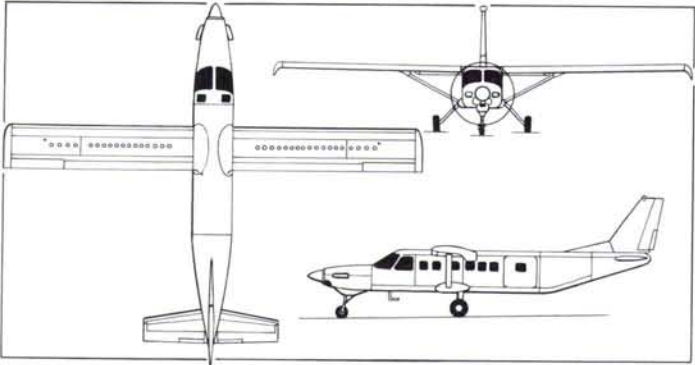
Radar: INI 82A colour radar indicator.

Flight: KI 256 ADI, KI 229 RMI, KI 525A HSI, KN 62A DME, KR 87 ADF, KC 192 flight computer, KEA 130 encoding altimeter, VOR/LOC/GS indicator.

Instrumentation: Moritz engine instruments and annunciator panel, ASI, electric artificial horizon, sensitive altimeter, gyro pressure gauge with source indicator, rate of climb indicator, turn-and-bank indicator, flap position indicator, digital voice record clock.



VulcanAir VF 600w Mission light utility turboprop (Paul Jackson) 0576506



VulcanAir VF 600w Mission general arrangement (James Goulding) 0587526

DIMENSIONS, EXTERNAL:	
Wing span	15.30 m (50 ft 2½ in)
Length overall	13.12 m (43 ft 0½ in)
Height overall	4.55 m (14 ft 1¼ in)
Tailplane span	5.00 m (16 ft 4¾ in)
Wheel track	3.50 m (11 ft 5¾ in)
Passenger door: Height	1.10 m (3 ft 7¼ in)
Width	0.60 m (1 ft 1½ in)
Cargo door: Height	1.40 m (4 ft 7 in)
Width	1.10 m (3 ft 7¼ in)
Service door: Height	1.40 m (4 ft 7 in)
Width	0.80 m (2 ft 7½ in)
DIMENSIONS, INTERNAL:	
Cabin:	
Length, excl flight deck	5.08 m (16 ft 8 in)
Max width	1.23 m (4 ft 0¼ in)
Max height	1.17 m (3 ft 10 in)
Volume	7.3 m³ (258 cu ft)
Baggage compartment:	
Length	0.41 m (1 ft 4 in)
Max width	1.23 m (4 ft 0¼ in)
Max height	1.17 m (3 ft 10 in)
Volume	0.59 m³ (20.84 cu ft)

AREAS:	
Wings, gross	24.80 m² (266.9 sq ft)

WEIGHTS AND LOADINGS:	
Weight empty: passenger	2,000 kg (4,409 lb)
freighter	1,950 kg (4,299 lb)
Max payload	1,600 kg (3,527 lb)
Max fuel weight	1,040 kg (2,293 lb)
Max T-O weight	3,925 kg (8,653 lb)
Max ramp weight	3,946 kg (8,699 lb)
Max landing weight	3,720 kg (8,201 lb)
Max zero-fuel weight	3,600 kg (7,937 lb)
Max wing loading	158.27 kg/m² (32.42 lb/sq ft)
Max power loading	6.77 kg/kW (11.12 lb/shp)

PERFORMANCE:	
Max level speed	190 kt (352 km/h; 219 mph)
Max cruising speed:	
at FL100	183 kt (339 km/h; 211 mph)
at FL200	166 kt (307 km/h; 191 mph)
Stalling speed, flaps down	61 kt (113 km/h; 71 mph)
Max rate of climb at S/L	274 m (900 ft)/min
Service ceiling	6,095 m (20,000 ft)
T-O run	433 m (1,420 ft)
FAA balanced field T-O length	616 m (2,020 ft)
FAA balanced field landing length	519 m (1,700 ft)
Landing run	244 m (800 ft)
Max range at FL200	1,190 n miles (2,204 km; 1,369 miles)
Endurance at FL200	6 h 48 min
g limits	+3.5/-1.4

VULCANAIR VA 300

TYPE: Light utility twin-prop transport.

PROGRAMME: Announced at Paris, June 1999, as a concept based on the VulcanAir AP.68TP Viator. Diesel engine test-flown on a tri-motor-configured P.68C in March 2001 and Phase 1 of the certification process has been completed; flying with the diesel engines running was due to start in late 2001, but the programme was delayed pending delivery of engines and certification target date put back to 2005. By 2006, however, the VA 300 was no longer being promoted.



Retouched image, showing projected VulcanAir VA 300 0085593

Japan

FUJI

FUJI JUKOGYO KABUSHIKI KAISHA (FUJI HEAVY INDUSTRIES LTD)

Subaru Building, 7-2 1-chome, Nishi-Shinjuku, Shinjuku-ku, Tokyo 160-8316

Tel: (+81 3) 33 47 25 25

Fax: (+81 3) 33 47 25 88

e-mail: okak@sb.hq.subaru-fhi.co.jp

Web: www.fhi.co.jp

PRESIDENT: Takeshi Tanaka

GENERAL MANAGER: Youichi Sugimura

DEPUTY GENERAL MANAGER: Tsunenori Hoshi

AEROSPACE COMPANY:

1-1-11 Yonan, Utsunomiya, Tochigi 320-8564

Tel: (+81 28) 684 77 77

Fax: (+81 28) 684 77 78

PRESIDENT: Norihisa Matsuo

SENIOR VICE-PRESIDENT AND GENERAL MANAGER: Hiroyuki Nakatsubo

VICE-PRESIDENT AND DEPUTY GENERAL MANAGER: Kisaburo Wani

DEPARTMENT GENERAL MANAGERS:

Kenichiro Usuki (Commercial Marketing and Sales)

Shunji Notake (Defence Market Development)

Takehiko Sarukawa (Administration)

UTSUNOMIYA FACTORY:

Handa Plant, 1-27 Shiohi-cho, Aichi 475-0032

Tel: (+81 569) 29 48 01

Fax: (+81 569) 29 48 10

Established 15 July 1953 as successor to Nakajima, Utsunomiya headquarters occupies 47.7 ha (117.9 acre) site, including 153,000 m² (1,646,880 sq ft) floor area; workforce 2,745 in April 2000. On 20 April 2006, Fuji announced completion of two new plants at Handa, one to manufacture aircraft composites material parts and the other to assemble wing centre-section boxes for its participation in the Boeing 777/787 and Kawasaki C-X/P-X programmes.

Fuji producing Bell UH-1J (see *Jane's Aircraft Upgrades*); delivered last of 89 AH-1S attack helicopters (serial No. 73492) to JGSDF on 14 December 2000; now producing T-7 trainer and is prime contractor for JGSDF AH-64D; manufactured wings, tailplanes and canopies for Kawasaki T-4; produces tail units and canopies for Kawasaki OH-1; wings and tail units for Mitsubishi F-2; outer wings, nacelles and tail unit for ShinMaywa US-1A/US-2. Responsible for wings and tailfins of Kawasaki C-X and P-X. Is also pursuing concept studies for very light jet, tentatively named *Subaru Jet*, to materialise "within 10 years".

Commercial aircraft components produced are elevators for Boeing 737; spoilers, inboard and outboard ailerons for Boeing 747; outboard flaps for Boeing 757; wing/body fairings and main landing gear doors for Boeing 767 and 777, plus front centre wing box for 777, with 787 centre wing to follow; and complete wing sets for the Hawker Horizon business jet (which see). Company was selected in May 2000 as risk-sharing subcontractor to produce composites fuselages for Bell/Agusta BA609 tiltrotor; named in June 2002 as vertical tail leading/trailing-edge source for Airbus A380; agreement in October 2003 with Eclipse Aviation to manufacture entire wing assembly for Eclipse 500, this beginning in March 2006. Other products include BQM-34AJKai (modified Firebee) and JAQM-1 target drones and RPH-2 and FFOs unmanned helicopters (see *Jane's Unmanned Aerial Vehicles and Targets*).

Fuji has participated in such projects as design of the HOPE-X space shuttle and development of an NAL aero-spaceplane. Research continues towards an SST/HST (supersonic/hypersonic transport), including a thermal protection system, heat-resistant structures and composites materials.

FUJI T-7

TYPE: Basic turboprop trainer.

PROGRAMME: Modification (Fuji designation KM-2D) of JASDF piston-engined T-3, which it is intended to replace on an approximately one-for-one basis. Selected by JDA (in preference to Pilatus PC-7 Mk IIM) in third quarter 1998 to meet T-7 requirement; two prototypes included in FY99 budget request, but in late 1998 procurement deferred for one year. JDA reopened competition in August 1999, with bids in third quarter 2000: T-3Kai selected as basis for T-7. September 2000: first 11 T-7s approved in FY01 budget. A T-3Kai prototype was test flown and awarded JCAB type certificate. First two production aircraft (26-5901 and 26-5902; first flight July 2002) delivered to Air Development & Test Wing at Gifu in September 2002 and to training unit 12 Hikotai Kyokudan at Hofu in April 2003; nine delivered by end of 2003, including seven in that year.

CUSTOMERS: JASDF requirement for 47 T-7s; 11 funded in FY01 defence budget; further 10 in FY02, nine in FY03 and 11 in FY04; three in FY05; three in FY06. Equip 11th and 12th Flying Training Wings at Shizuhama and Hofu respectively. At least 32 delivered by end of 2005 (two in 2002; seven in 2003; 13 in 2004; and balance in 2005).

DESIGN FEATURES: Modifications to engine cowling, wings and tail unit (last-named swept) compared with T-3.

Wing section NACA 23016.5 at root, NACA 23012 at tip; dihedral 6° from roots; sweepback 0° at quarter-chord.

FLYING CONTROLS: Conventional and manual. Plain ailerons, each with balance tab (port tab controllable for trim); controllable tab in each elevator; anti-balance tab in rudder. Single-slotted flaps.

STRUCTURE: Two-spar all-metal wing; all-metal semi-monocoque fuselage.

LANDING GEAR: Electrically retractable tricycle type (nosewheel rearward, mainwheels inward).

POWER PLANT: One 336 kW (450 shp) Rolls-Royce 250-B17F turboprop; three-blade propeller. Two bladder-type fuel tanks in each wing, combined capacity 375 litres (99.0 US gallons; 82.4 Imp gallons).

ACCOMMODATION: Crew of two in tandem. Dual controls standard.

SYSTEMS: Include vapour cycle air conditioning system.



Fuji T-7 basic turboprop trainer of JASDF (Matsuhiro Kadota)

1158166

AVIONICS: Include VHF, UHF, ATC transponder, ICS and Tacan.

DIMENSIONS, EXTERNAL:

Wing span	10.04 m (32 ft 11 1/4 in)
Wing aspect ratio	6.1
Length overall	8.59 m (28 ft 2 1/4 in)
Height overall	2.96 m (9 ft 8 1/2 in)
Tailplane span	3.71 m (12 ft 2 in)
Propeller diameter	2.12 m (6 ft 11 1/2 in)

AREAS:

Wings, gross	16.50 m ² (177.6 sq ft)
Fin	1.28 m ² (13.78 sq ft)
Rudder, incl tab	0.66 m ² (7.10 sq ft)
Tailplane	2.07 m ² (22.28 sq ft)
Elevators (total, incl tabs)	1.39 m ² (14.96 sq ft)

WEIGHTS AND LOADINGS:

Max T-O weight	1,585 kg (3,494 lb)
Max wing loading	96.1 kg/m ² (19.67 lb/sq ft)
Max power loading	4.73 kg/kW (7.76 lb/shp)

PERFORMANCE:

Max level speed	203 kt (376 km/h; 233 mph)
Econ cruising speed at 915 m (3,000 ft)	161 kt (298 km/h; 185 mph)
Stalling speed, flaps and gear down	56 kt (104 km/h; 65 mph)
Service ceiling	7,620 m (25,000 ft)
T-O to 15 m (50 ft) at S/L	608 m (1,995 ft)
Landing from 15 m (50 ft) at S/L	566 m (1,860 ft)

FUJI (BOEING) AH-64DJP

TYPE: Attack helicopter.

PROGRAMME: To replace existing JGSDF fleet of 80-plus AH-1Ss; original AH-X requirement said to be for up to 100, and government approval to acquire first 10 of selected design announced on 15 December 2000; these to be delivered by March 2006. RFP, issued 27 March 2001, resulted in submissions from Fuji/Boeing (AH-64D) and Mitsubishi/Bell (AH-1Z Viper), selection of former being announced on 27 August 2001. Selection of initially more expensive AH-64D said to be justified on grounds of better 20-year life-cycle costs, enabling smaller total number of aircraft to be procured; requirement accordingly now expected to be fulfilled by between 50 and 60 aircraft, of which only a proportion (possibly no more than one-third) to have Longbow radar.

Initial batch (possibly all of first 10) to be US-built, with Fuji as prime contractor for remainder; funding for first two included in FY02 budget allocations, followed by two more in each of FYs 03, 04 and 05; one in FY06; one in FY07. First Boeing built AH-64DJP (provisional designation) completed late 2004 with DoD serial 02-0004 and US civil registration N3216N; handed over (in US) 15 December 2005, delivered by Fuji to JDA 15 March 2006, having made maiden flight in Japan on 25 January 2006, newly serialised 74501.

POWER PLANT: General Electric T700-GE-701C turboshafts confirmed.

SYSTEMS: Kanto (Smiths licence) electrical power generating system.

AVIONICS: Customer-specified, including new digital nav/com and datalinks.

ARMAMENT: Raytheon AIM-92 Stinger AAMs.



First Fuji (Boeing) AH-64DJP conducting its maiden flight in Japan (Subaru)

1158251

GEN

GEN CORPORATION

5652-83 Sasaga, Matsumoto-shi, Nagano-ken 399-0033
Tel: (+81 263) 26 12 12
Fax: (+81 263) 26 12 13
e-mail: aviation@gen-corp.jp
Web: www.gen-corp.jp
PRESIDENT AND DESIGNER: Gennai Yanagisawa

US AGENT:
Ace Craft USA
Platte City, Montana
Web: www.acecraftusa.com

Mr Yanagisawa, whose nickname is 'Gen', developed a small, but comparatively high-powered, horizontally opposed two-cylinder engine while working for the Zenoa company. By 1985, this had been tested in a hang-glider, para-glider and model aircraft, but failed to find a market. Tests of a coaxial rotor RPV in 1987 were unsuccessful because of control problems, while a manned twin-engined design in 1992 failed to produce sufficient lift. By 1994, however, this had evolved into the BDH-1 (Boy's Dream Helicopter 1), exhibited at that year's Japan Aerospace Show. A three-engined BDH-2 followed in 1996 and was further modified as the BDH-3 which, although successful, was unable to sustain height with one engine inoperative.

Development and promotion handled initially by the designer's diverse manufacturing company, Gen Yanagisawa Engineering System, but in 2004 the Gen Corporation was established specifically for this purpose. The BDH-4 was shown at AirVenture, Oshkosh, USA, in 1997 and continues to be refined. The assistance of a US agent was enlisted to collaborate on H-4 trials, such as ballistic parachutes and high-speed cruising, which are prohibited by Japanese air law. Numerous successful demonstration flights had been made in Japan by early 2006, including an appearance at the Japan Aerospace 2004 show in Yokohama. The remote control system has been further developed since 2002 and a UAV version is planned.

GEN H-4

TYPE: Exoskeleton flying vehicle.
PROGRAMME: Four-engined development of BDH-3; basic version shown at AirVenture, Oshkosh, 1997; yaw control by small, electrically powered, auxiliary propellers; by 1998, yaw accomplished by differentiation of rotor rpm. Two prototypes; current configuration first flew in 1999. Marketed in kit form only. Current Japanese demonstrators, registered JX0076 and JX0077, are production version.



Details of Gen H-4 power plant, rotor head and fuel storage (Matsuhiko Kadota)

1158256

CURRENT VERSIONS: **H-4:** As described.
H-4 UAV: Radio-controlled version, first flown 22 March 2002. Development continuing.
CUSTOMERS: Five customer aircraft completed by March 2005.
COSTS: Kit USD35,900 (2006); not available ready-built.
DESIGN FEATURES: 'Strap-on' personal helicopter with contrarotating twin blades of tapered planform and fixed pitch (thus no autorotation capability — replaced by ballistic parachute, if desired). Seat, with fuel tank at rear, supported by triangular tube framework landing gear and footrest. Gimballed platform above occupant's head houses four small motors, central transmission and rotor assembly with gears. Combined hand-grip control column and instrument panel attached to front of platform. Rotor speed 800 to 900 rpm. Quoted build time 40 hours.
FLYING CONTROLS: Two-axis control by tilting of engine/rotor platform; yaw control effected by thumb switch on instrument panel, operating electric motor which differentiates speed of rotors by 1 per cent.
STRUCTURE: Framework of 5 cm (2 in) aluminium tube; glass fibre seat and backpack; rotors of carbon fibre and Kevlar, with foam core.
LANDING GEAR: Four small 'wheels' each comprise multiple rollers in circular arrangement.
POWER PLANT: Four 124 cc (7.56 cu in) Gen 125 two-stroke, horizontally opposed, two-cylinder piston engines with independent ignition, positioned symmetrically on pivoting platform, each developing 7.5 kW (10 hp) at 8,500 rpm. Fuel, of 30:1 petrol and oil premix, in seatback tank, capacity up to maximum of 19 litres (5.0 US gallons; 4.2 Imp gallons).
DIMENSIONS, EXTERNAL:
Rotor diameter (each) 4.00 m (13 ft 1½ in)
Height overall 2.44 m (8 ft 0 in)
AREAS:
Rotor disc (each) 12.57 m² (135.3 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 70 kg (154 lb)
Max T-O weight 220 kg (485 lb)
PERFORMANCE:
Never-exceed speed (VNE) 108 kt (200 km/h; 124 mph)
Cruising speed 43 kt (80 km/h; 50 mph)
Service ceiling 3,000 m (9,840 ft)
Endurance up to 1 h



Gen H-4 being checked for size (Matsuhiko Kadota)

1158255

JADC

JAPAN AIRCRAFT DEVELOPMENT CORPORATION

Hibiya Kokusai Building/7F, 2-2-3 Uchisaiwai-cho, Chiyoda-ku, Tokyo 100-0011

Tel: (+81 3) 35 03 32 25

Fax: (+81 3) 35 04 03 68

Web: www.jadc.or.jp

CHAIRMAN: Kyoji Takenaka

VICE-CHAIRMAN: Teiichi Nishikawa

SENIOR MANAGING DIRECTOR: Toshinori Nishi

MANAGING DIRECTORS:

Yoichi Sugimura

Atsushi Kaneko

GENERAL MANAGER: Yasutada Sasaki

Known as CTDC (Civil Transport Development Corporation) from 30 March 1973 until 27 December 1982, JADC is a non-profit consortium established by airframe manufacturers Mitsubishi, Kawasaki and Fuji to promote commercial aircraft business; members now also include Nippi and ShinMaywa.

Current development programme is as partner in Boeing 787 Dreamliner; research programmes include high-speed transport studies; next-generation avionics; plus R&D for high-performance and environmental adaptability of small aircraft.

JADC YSX

TYPE: Regional jet airliner.

PROGRAMME: Feasibility studies, continuing in 2006, are intended for market slot between current regional jets and larger, single-aisle jets. JADC responsible for establishing configuration and structural parameters. Possibility of linking YSX with developing military aircraft such as Kawasaki P-X and C-X programme.

KAC

KANEMATSU AEROSPACE CORPORATION

1-1-2 Shibaura, Minato-ku, Tokyo 105-8005

Tel: (+81 3) 54 40 81 11

Fax: (+81 3) 54 40 65 00

e-mail: pr@kanematsu.co.jp

Web: www.kanematsu.co.jp

CHAIRMAN: Tadashi Kurachi

PRESIDENT AND CEO: Yoshihiro Miwa

SALES DIVISION MANAGER: Akio Ohdoi

PUBLIC RELATIONS: Kazumasa Sato

The Aerospace Department of Kanematsu's IT Division (workforce 879 at 31 March 2005) is prime contractor for outfitting Hawker 800s to JASDF specifications. Fuji is systems integrator and responsible for U-125/U-125A maintenance. Kanematsu is also Japanese distributor for Embraer ERJ-145.

KANEMATSU (HAWKER) 800

JASDF designations: U-125 and U-125A

TYPE: Multirole twin-jet.

PROGRAMME: Hawker 800 (which see) selected under JASDF H-X programme to replace Mitsubishi MU-2J and MU-2E in naval calibration and SAR roles respectively; first U-125 delivered to JASDF 18 December 1992 and first U-125A (52-3001) delivered on 11 December 1994; three U-125As delivered by 31 January 1995 in preparation for formal handover. First six U-125As assembled in UK; seventh aircraft (from Wichita production line) delivered to Kanematsu November 1997; 21st arrived in Japan in January 2003 for fitting out; 22nd in December 2003; and 23rd in August 2005.

CURRENT VERSIONS: **U-125:** For naval flight check role, replacing MU-2J; operated by Flight



Kanematsu (Hawker) U-125A SAR twin-jet (Matsuhiro Kadota)

1158167

Check Group at Iruma. Three ordered; all delivered from UK production.

U-125A: Search and rescue version, replacing MU-2E; 360° search radar, FLIR, airdroppable marker flares, liferaft and rescue equipment. Operated by detachments of the Air Rescue Wing at Chitose, Hyakuri, Komatsu and Naha, initially going to its Training Squadron at Komaki.

CUSTOMERS: JASDF (three U-125 and 24 U-125A ordered by FY04; one approved in FY05; one in FY06; one in FY07. Options for total of 27 U-125As. Kanematsu received No. 24 for outfitting in May 2006.

COSTS: JPY3.85 billion (2000).

DESIGN FEATURES: U-125A has deep observation 'patio' window each side of fuselage immediately ahead of wing, and dinghy/rescue pack dropping system via pressure door built into lower fuselage which is exposed for operation when landing gear is deployed.

AVIONICS (U-125A): **Radar:** Toshiba-built Raytheon APQ-2 360° search radar (seven ordered November 2005 in USD8.6 million contract).

Mission: Mitsubishi Electric IR imager in retractable underfuselage turret.

EQUIPMENT (U-125A): Flare and marker buoy dispenser; liferaft.

U-125/A PROCUREMENT AND DELIVERY(JASDF)

(at 1 January 2007)

Ordered			Delivered		
FY	U-125	U-125A	CY	First Acft	Qty
90	1		92	29-3041	1
91	1		93	39-3042	1
92	1		94	49-3043	1
92		3	95	52-3001	3
93		1	96	62-3004	1
94		1	97	72-3005	2
95		2	98	82-3007	3
96		3	99	92-3010	3
97		4	00	02-3013	3
98		3	01	12-3016	3
99		2	02	22-3019	2
00		2	03	32-3021	1
01		1	04	42-3022	1
02					
03		1	05	52-3023	1
04		1			
05		1			
06		1			
07		1			
Totals	3	27			30

KAWASAKI

KAWASAKI JUKOGYO KABUSHIKI KAISHA (KAWASAKI HEAVY INDUSTRIES LTD)

Kobe Crystal Tower, 1-3 Higashi-Kawasaki-cho 1-chome, Chuo-ku, Kobe, Hyogo 650-8680

Tel: (+81 78) 371 95 30

Fax: (+81 78) 371 95 68

Web: www.khi.co.jp

AEROSPACE GROUP/GAS TURBINE & MACHINERY GROUP:

World Trade Center Building, 4-1 Hamamatsu-cho 2-chome, Minato-ku, Tokyo 105-6116

Tel: (+81 3) 34 35 21 11

Fax: (+81 3) 34 36 30 37

Web: www.khi.co.jp/aero/airplane.html

PRESIDENT: Chikashi Motoyama

MANAGING DIRECTOR AND PRESIDENT OF AEROSPACE COMPANY: Takashi Sugoh

MANAGING DIRECTOR AND PRESIDENT OF GAS TURBINE & MACHINERY GROUP:

Takashi Yoshino

SENIOR STAFF OFFICER, MARKETING AND SALES: Shojiro Ootake

WORKS: Gifu, Nagoya 1 and 2 (Aerospace Group); Akashi and Seishin (Gas Turbine & Machinery Group)

Company originated 1923 at Gifu when opened as Kakumigahara subplant for aircraft division of Kawasaki Dockyards. Present Gifu facility is on 71.2 ha (176 acre) site with 291,000 m² (3.13 million sq ft) covered area. Nagoya 1 Works, opened December 1992, has site and covered areas of 7.1 ha (17.5 acres) and 10,000 m² (107,650 sq ft) respectively; corresponding figures for Nagoya 2 (opened 1979) are 1.8 ha (4.4 acres) and 6,000 m² (64,600 sq ft).

Kawasaki Aircraft Company has built many US aircraft under licence since 1955; amalgamated with Kawasaki Dockyard Company and Kawasaki Rolling Stock Manufacturing Company to form Kawasaki Heavy Industries Ltd 1 April 1969; Aerospace Group employs some 3,200 people; Gas Turbine & Machinery Group has some 800 aerospace-related employees. Kawasaki acquired 25 per cent holding in Nippi in 1970; increased to 100 per cent with effect from 1 April 2003.

Kawasaki is prime contractor for OH-1 observation helicopter; now also leading development of C-X/P-X transport/maritime patroller programme; co-developer and co-producer, with Eurocopter, of BK 117/EC 145 helicopter; those EC 145s produced in Japan continue to be marketed as the BK 117C-2. Is prime contractor for Japanese licensed production of CH-47 Chinooks for JGSDF and JASDF; was prime contractor for P-3C variants for JMSDF and T-4 for JASDF (now completed); also built MD Helicopters MD 500 under licence. Selected on 5 June 2003 as prime contractor for EH101 helicopters ordered by Japan, first of which handed over to JMSDF 3 March 2006.

Subcontract work includes centre fuselage for Mitsubishi F-2; currently producing forward and centre-fuselage barrel sections and wing ribs for Boeing 767 and 777, plus rear centre

wing box and rear pressure bulkhead for 777; now also to produce forward fuselage, fixed portion of wing trailing edge and main landing gear wheel wells of Boeing 787, for which new plant at Nagoya 1 opened in 2006. Delivery of blended winglets for retrofit of early-model Boeing 737s (~300/400/500) began in October 2002. Acquisition of Nippi brought in additional component work for Boeing 747 (fuselage frames) and 777 (wing in-spar ribs and nosewheel doors); Mitsubishi F-2 (wing pylons); and ShinMaywa US-2 (main landing gear fairing). Kawasaki also responsible for design and sole-source manufacture of transmission for MD Helicopters Explorer; in 1999 signed agreement with Aerostructures of USA to manufacture cabin doors and tailcones for Bell/Agusta BA609. Risk-sharing partner on Embraer 170/175 and 190/195, for which wing components of former produced by Kawasaki from April 2001. Kawasaki Aeronáutica do Brasil established April 2002 and new Neiva-built facility at Gavião Peixoto, 300 km (186 miles) north-west of São José dos Campos, inaugurated 24 April 2003; first set of wings for 190/195 shipped to Embraer 10 October 2003. Nominated as prime contractor for maintenance and support of JASDF E-2C Hawkeyes, E-767 AWACS and C-130 Hercules.

Kawasaki also extensively involved in satellites and launch vehicles; is member of International Aero Engines consortium and produces T53 and T55 engines under licence (see *Jane's Aero-Engines*); overhauls engines; and builds hangars, docks, passenger bridges and other airport equipment.

KAWASAKI C-X and P-X

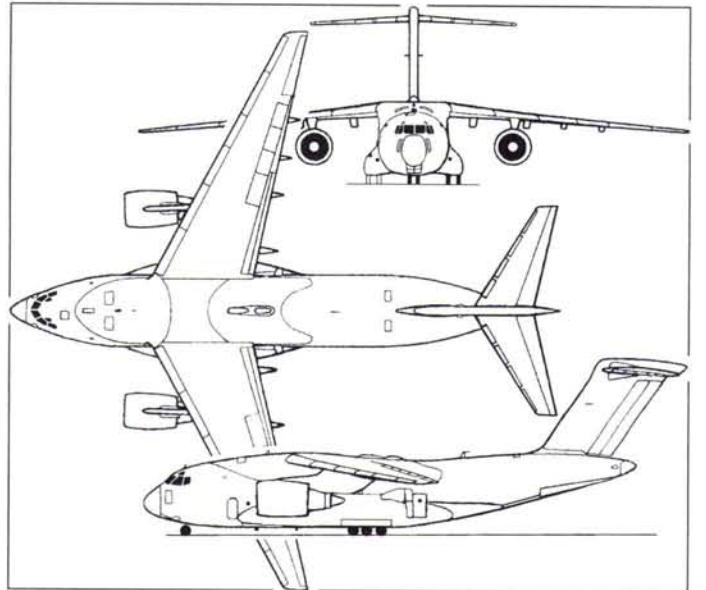
TYPE: Medium transport/multirole (C-X); maritime reconnaissance four-jet (P-X).
PROGRAMME: Initial development funding of JPY5.3 billion in FY01; RFP issued in May 2001. Foreign proposals for C-X included Airbus A310, Boeing C-17 and Lockheed Martin C-130J, but Kawasaki selected by JDA on 27 November 2001 to lead development of an indigenous design to meet both C-X and P-X requirements, with optimum degree of structural commonality; Fuji and Mitsubishi involved in programme, which could also lead to a 100- to 150-seat civil transport version for production post-2010, although C-X civilian freighter was being promoted by 2006, involving minimal change from military variant. Two-year design phase begun in 2003, with prototype/preproduction development following from 2005 (JPY64 billion (USD589 million) contract March of that year). First flights targeted for 2007; engineering and operational testing until 2009 for P-X, 2010 for C-X; service entry 2011 and 2012 respectively. Wooden mockups of each aircraft displayed at Gifu in late 2004. C-X static test airframe (01) handed over to TRDI at Gifu on 16 March 2006, having been transferred from Kawasaki's local plant in December 2005 and subsequently assembled. P-X 01 static test frame to follow, while C-X 1 and P-X 1 flying prototypes under construction by early 2006; former targeted for completion in March 2007 and maiden flight in mid-year; P-X 1 approximately six months later.

CURRENT VERSIONS: **C-X:** To fulfil long-standing JASDF requirement to replace current Kawasaki C-1A fleet with a transport of increased range and payload capacity. Features include a twin-turboprop power plant and a payload approximately double that of the Lockheed Martin C-130; earlier need for secondary aerial tanker capability no longer applicable, but envisaged also as commercial airlifter for oversize cargo. According to JDA's Technical Research and Development Institute (TRDI) in late 2000, design parameters include high-mounted wing, rear-loading ramp/door, digital AFCS and 'glass cockpit' avionics; outer wing and flight deck to be common with those of JMSDF's P-X. Engine RFP issued by TRDI 16 December 2002; General Electric CF6-80C2 selected 12 August 2003, in preference to PW4000 and R-R Trent 500.

P-X: Patrol version for JMSDF. Outer wing and flight deck as for C-X, but different fuselage cross-section; wing to be low-mounted, carrying four (lower-powered) engines instead of two; low-set (instead of T) horizontal tail; AFCS to be fly-by-light as protection against electromagnetic interference (EMI). TRDI and IHI developing XF7-10 engine, further seven of which ordered April 2005, increasing total to 12. Under flight test in late 2005, in starboard outer position on Kawasaki C-1 testbed. P-X static test fuselage handed



P-X (nearest) and C-X mockups 1158254



Kawasaki C-X general arrangement (Paul Jackson) 1158503

over to Japan Defence Agency (at TRDI, Tachikawa) on 13 October 2006. Envisaged also as basis for possible 110/130-seat commercial airliner.
CUSTOMERS: At least 44 C-Xs required by JASDF, to replace C-1As and C-130Hs; JMSDF needs about 80 P-Xs to replace Kawasaki (Lockheed Martin) P-3C fleet. Eight C-X and four P-X envisaged in current five-year plan.
COSTS: JPY80 billion allocated to programme in FY03; further JPY86 billion (USD800 million) earmarked for FY04; JPY78.3 billion requested for FY05. Overall development costs estimated in 2004 at JPY340 billion for aircraft and JPY20 billion for XF7-10 engine.

Following details are provisional:
POWER PLANT: C-X: Two 222 to 267 kN (50,000 to 60,000 lb st) class General Electric CF6-80C2L1F turbofans; Goodrich nacelles.
P-X: Four 53.4 kN (12,000 lb st) class IHI XF7-10 turbofans.
LANDING GEAR: Six-wheel main bogies (three tandem pairs), retracting into fuselage-side fairings; forward-retracting twin nosewheels.
ACCOMMODATION: Two-crew flight deck, with option for third member. Rear-loading ramp and retractable floor rollers on C-X.
SYSTEMS: Honeywell APU, ram air turbine and environmental control system.



C-X (left) and P-X static test airframes under construction in late 2005 1158252



Cutaway drawings of Kawasaki C-X (left) and P-X 1162252

AVIONICS: In process of selection; include triple-redundant fly by wire FCS, fully integrated FMS, HUDs and onboard maintenance system. CAE AN/ASQ-508(V) MAD chosen for P-X in February 2004; some others by Honeywell.

EQUIPMENT: Honeywell sonobuoy dispensers for P-X. Cargo handling and parachute extraction system for C-X by AAR Cargo Systems and ShinMaywa.

DIMENSIONS, EXTERNAL:

Wing span: P-X 35 m (114.8 ft)
C-X 44.4 m (145.7 ft)
Length overall: P-X 38 m (124.7 ft)
C-X 43.9 m (144.0 ft)
Ramp length: C-X 5.5 m (18 ft)
Height overall: P-X 12 m (39.4 ft)
C-X 14.2 m (46.6 ft)

DIMENSIONS, INTERNAL:

Cargo hold (C-X):
Length 16 m (52.5 ft)
Max width 4 m (13.1 ft)
Max height 4 m (13.1 ft)
Ramp length: C-X 5.5 m (18 ft)

WEIGHTS AND LOADINGS:

Operating weight empty: C-X 60,800 kg (134,040 lb)
Max payload: C-X 37,600 kg (82,894 lb)
Basic T-O weight:
P-X 80,000 kg (176,370 lb)
C-X 141,100 kg (311,072 lb)

PERFORMANCE (design):
Cruising speed:
C-X at FL400 M0.8
P-X at FL300 450 kt (833 km/h; 518 mph)
Max operating altitude: C-X 12,200 m (40,000 ft)
T-O field length: C-X 2,300 m (7,545 ft)
Landing field length: C-X 2,400 m (7,875 ft)
Range:
C-X with max payload 3,023 n miles (5,600 km; 3,479 miles)
C-X with 12,000 kg (26,455 lb) payload 4,805 n miles (8,900 km; 5,530 miles)
C-X (self-ferry) 5,399 n miles (10,000 km; 6,213 miles)
P-X 4,300 n miles (7,963 km; 4,948 miles)



Kawasaki OH-1 armed observation helicopter (Mitsuhiro Kadota)

1158168

KAWASAKI OH-1

TYPE: Armed observation helicopter.

PROGRAMME: Developed to replace OH-6Ds of JGSDF, Japan Defence Agency (JDA) awarded JPY2.7 billion (USD22.5 million) in FY92 to cover basic design phase of helicopter then provisionally designated OH-X; RFPs issued by JDA's Technical Research & Development Institute (TRDI) 17 April 1992; Kawasaki selected as prime contractor (60 per cent of programme) 18 September 1992, with Fuji and Mitsubishi (20 per cent each) as partners; Observation Helicopter Engineering Team (OHCET), formed by these three companies, began preliminary design phase 1 October 1992. Mockup made public 2 September 1994 under Japanese name *Kogata Kansoku* (new small observation [helicopter]).

Programme included six prototypes (four flying, two for ground test); first aircraft (32001) rolled out at Gifu on 15 March 1996 and made first flight 6 August 1996, followed by second prototype on 12 November; OH-1 designation assigned late 1996; first two XOH-1s handed over to JDA on 26 May and 6 June 1997; third flown on 9 January 1997, at which time earlier aircraft had accumulated some 30 and 20 hours, respectively; handed over 24 June 1997; fourth flown on 12 February 1997 and handed over 29 August 1997. Prototypes renumbered by 1999 from 32001-04 to 32601-04.

First three production OH-1s funded FY97 and ordered 1998; first prototype flown with more fuel-efficient TS1-10QT (replacing XTS1-10) engines, 30 March 1998. By early 1999, four prototypes had flown 450 hours and were due to complete further 450 hours by end of 1999, including operational evaluation at Akeno JGSDF base. First production OH-1 (32605) flown July 1999 and handed over to JGSDF at Gifu 24 January 2000.

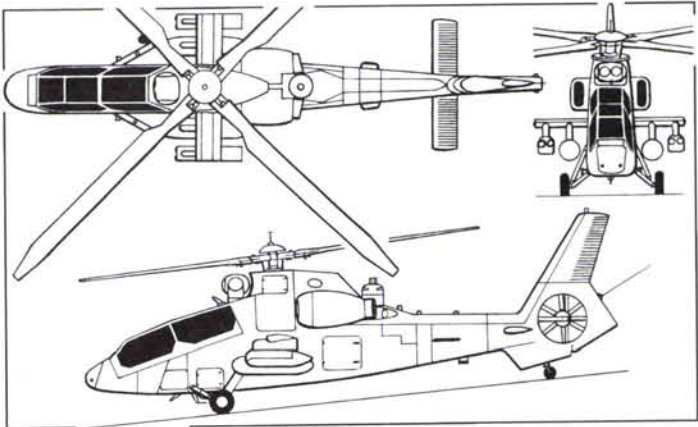
Name 'Ninja' reportedly given in 2002, but not officially confirmed.

CURRENT VERSIONS: **OH-1:** Basic initial production version; *as described*.

Growth versions: Under study with more powerful engines (possibly LHTEC T800 or R-R/Turbomeca/MTU MTR 390) and uprated gearbox. **OH-1Kai** is possible candidate for AH-X requirement with tentative designation AH-2, armour-plated forward and centre fuselage, upgraded engines and transmission and additional weapons carriage. Utility version reportedly also being considered as possible replacement for Fuji (Bell) UH-1J (UH-X programme).

CUSTOMERS: See table. Total of 26, including prototypes, ordered by FY05; at least 20 delivered by 31 December 2005; two approved for FY06; two for FY07. Japan Ground Self-Defence Force requirement for 150 to 200.

Hiko Jikkentai (Flight Test Squadron) formed at Akeno with first four production aircraft on 27 March 2001; other deliveries by late 2002 included small numbers to Kasumigaura Bunko, Utsunomiya Bunko and Kyoiku Shien Hikotai (at Akeno), all of which are departments of the Army's Koku Gako (Aviation School). 1st Taisensha Herikoputatai (Anti-Tank Helicopter Squadron) at Tokashi began receiving OH-1s to replace OH-6Ds in 2003.



Kawasaki OH-1 (two Mitsubishi TS1 turboshafts) (James Goulding)

1158169

COSTS: Funding for development, prototypes and flight testing JPY2.5 billion in FY92, JPY10.2 billion in FY93, JPY50.1 billion in FY94 and JPY23.3 billion in FY95. Unit costs of first four production lots JPY1.924 billion (FY97), JPY2.018 billion (FY98), JPY2.229 billion (FY99) and JPY2.075 billion (FY00).

DESIGN FEATURES: Kawasaki hingeless, bearingless and 20 mm ballistic-tolerant four-blade elastomeric main rotor and transmission system; Fenestron-type tail rotor with eight unevenly angled 'scissor' blades (35 and 55°); stub-wings for stores carriage. Active vibration damping system.

FLYING CONTROLS: Integrated AFCS and stability control augmentation system (SCAS).

STRUCTURE: Rotor blades and hub manufactured from GFRP composites; centre-fuselage and engines by Mitsubishi, tail unit/canopy/stub-wings/cowling by Fuji, rest by Kawasaki. Some 37 per cent of airframe (by weight) in GFRP/CFRP.

LANDING GEAR: Non-retractable tailwheel type. Provision for wheel/skis on main units.

POWER PLANT: Twin 659 kW (884 shp) FADEC-equipped Mitsubishi TS1-M-10 turboshafts (XTS1-10 originally in prototypes). Possibility of off-the-shelf alternative engines not ruled out. Transmission has 30-minute run-dry capability. Stub-wings can each carry a 235 litre (62.0 US gallon; 52.0 Imp gallon) auxiliary fuel tank.

ACCOMMODATION: Crew of two on tandem armoured seats (pilot in front). Flat-plate cockpit transparencies, upward-opening on starboard side for crew access.

AVIONICS: *Flight:* AFCS with stability augmentation and holding functions; dual HOCAS controls.

KAWASAKI OH-1 PROCUREMENT AND DELIVERY(JGSDF)

PROCUREMENT			DELIVERY			
FY	Qty	Cum total	FY	Qty	First aircraft	Cum total
93	2 ¹	2				
95	2 ¹	4				
97	2	7	97	4	32601	4
98	2	9				
99	3	12	99	3	32605	7
00	4	16				
01	2	18				
02	2	20				
03	2	22				
04	2	24				
05	2	26				
06	2	28				
07	2	30				

¹ XOH-1 prototypes

Instrumentation: Two Yokogawa Electric large, flat-panel, liquid crystal colour MFDs in each cockpit, linked to a MIL-STD-1553B databus; Shimadzu HUD in front cockpit.

Mission: Kawasaki electrically operated roof-mounted turret combining Fujitsu thermal imager, NEC real-time colour TV camera and NEC laser range-finder/designator; field of regard 110° in azimuth, 40° in elevation.

Self-defence: Spine-mounted IR jammer based on BAE Systems AN/ALQ-144.

ARMAMENT: Four Toshiba Type 91 (modified) lightweight, short-range, IR-guided AAMs on pylons under stub-wings for self-defence.

Following data all provisional:

DIMENSIONS, EXTERNAL:	
Main rotor diameter	11.6 m (38 ft 0¾ in)
Main rotor blade chord, constant portion	0.38 m (1 ft 3 in)
Wing span	3.0 m (9 ft 10 in)
Fuselage: Length	12.0 m (39 ft 4½ in)
Max width	1.0 m (3 ft 3¼ in)
Height: to top of rotor head	3.4 m (11 ft 1¾ in)
over tailfin	3.8 m (12 ft 5½ in)
Tailplane span	3.0 m (9 ft 10 in)

AREAS:	
Main rotor disc	105.68 m² (1,137.5 sq ft)

WEIGHTS AND LOADINGS:	
Weight empty	2,450 kg (5,401 lb)
Max weapons load	132 kg (291 lb)
T-O weight: design	3,550 kg (7,826 lb)
max	4,000 kg (8,818 lb)
Max disc loading	37.9 kg/m² (7.75 lb/sq ft)

PERFORMANCE:	
Max level speed	150 kt (277 km/h; 172 mph)
Combat radius	108 n miles (200 km; 124 miles)
Range	297 n miles (550 km; 342 miles)
g limits	+3.5/-1

KAWASAKI (BOEING) CH-47

JASDF/JGSDF designations: CH-47J and CH-47JA

TYPE: Medium lift helicopter.

PROGRAMME: FY84 defence budget approved purchase of three Boeing CH-47s, two for JGSDF and one for JASDF; first two built in USA and delivered second quarter 1986; Nos. 3 to 7 delivered as CKD kits for assembly in Japan; Kawasaki granted manufacturing licence for Japanese services' Chinooks; first CH-47Js delivered late 1986.

CURRENT VERSIONS: **CH-47J:** Generally similar to US CH-47D. Total 34 (from all sources) delivered to JGSDF by 1996, when CH-47JA introduced; procurement continued for JASDF.

CH-47JA: Designation introduced to describe CH-47Js delivered to army aviation from 1996 with nose-mounted weather radar; first (52951) was 35th JGSDF Chinook, 50th Japanese Chinook; total 15 delivered by late 2002. More recent JASDF Chinooks reported as CH-47JA variant.

CUSTOMERS: See table. Total of 85 ordered, of which 76 (including US-built) delivered by end of 2005. One J and one JA approved for FY07. JGSDF had requirement (now exceeded) for 52, of which 53 in service by late 2002. Operated by 1st and 2nd Squadrons of 1st Helicopter Brigade at Kisarazu (CH-47J), 1st Composite Brigade on Okinawa (CH-47JA) and Aviation School at Akeno.

JASDF 24 CH-47J delivered by end of 2005. Operated by Air Rescue Wing flights at Iruma, Kasuga, Misawa and Naha (Okinawa).

KAWASAKI CH-47J/JA PROCUREMENT

FY	JASDF	First aircraft	JGSDF	First aircraft	Cum total
84	1	67-4471	2	52901	3
85	1	77-4472	3	52903	7
86	3	87-4473	4	52906	14
87	2	97-4476	4	52910	20
88	3	07-4478	5	52914	28
89	2	27-4481	5	52919	35
90	2	37-4483	5	52924	42
91	1	47-4485	3	52929	46
92			3	52932	49
93			2 ²	52951	51
94			2 ²	52953	53



Kawasaki CH-47J of JASDF (Miatsuhiro Kadota)

1158170

FY	JASDF	First aircraft	JGSDF	First aircraft	Cum total
95	1	87-4486	2 ²	52955	56
96			2 ²	52957	58
97			2 ²	52959	60
98			1 ²	52961	61
99	2	07-4487	2 ²	52962	65
00	1 ²	37-4489	2 ²	52964	68
01	1 ²	47-4490	1 ²	52966	70
02	2 ²	57-4491	2 ²	52967	74
03	4 ²	57-4493	1 ²		79
04			2 ²		81
05			1 ²		82
06	2 ²		1 ²		85
07	1		1 ²		87
Totals	29		58		87

¹ First seven built in US (two) or assembled from kits

² CH-47JA

COSTS: Unit cost JPY4.5 billion for CH-47J, JPY5.1 billion for CH-47JA (2000).
AVIONICS: *Flight:* GPS in JGSDF aircraft from 1993; Mitsubishi Precision INS.

KAWASAKI (AGUSTAWESTLAND EH101) KHI-01

TYPE: Multirole medium helicopter.

PROGRAMME: Kawasaki selected 5 June 2003 as prime contractor for 14 EH101s to be ordered by Japan: 11 as JMSDF airborne mine countermeasures replacements for Sikorsky Sea Dragons and three as support transports for use in the Antarctic. All have rear loading ramp. Licensed production and support agreement signed 22 September 2003. First aircraft (test flown as G-17-518), ordered in FY03, is UK-built; shipped to Japan mid-June 2005 and handed over to JMSDF 3 March 2006. Delivery of first CKD kit followed in fourth quarter of 2005 and assembly under way by March 2006. Second (ordered in FY04) and subsequent aircraft assembled or manufactured by Kawasaki.

CURRENT VERSIONS: **CH101:** Designation of three aircraft to be configured for Antarctic support missions. First delivery scheduled for second quarter 2007.

MCH101: Airborne mine countermeasures (AMCM) version. Eleven to be so configured, replacing MH-53E Sea Dragon and S-61. First delivery (8651) due 3 March 2007, initially in utility role pending development completion of AMCM equipment (post-2010).

POWER PLANT: RRTM RTM322 turboshafts assembled in Japan by Kawasaki.

CUSTOMERS: JMSDF (requirement for 14); one ordered in FY03 and one in FY04; none in FY05 or FY06.

AVIONICS: *Mission:* EDO Corporation OASIS (Organic Airborne and Service Influence Sweep) mine countermeasures system, integration of which due to begin in 2011.



First (UK-built) KHI-01, delivered to JMSDF in March 2006

1158265



Cutaway of MCH101 mine countermeasures helicopter

1158257

KAWASAKI YPX

TYPE: Regional jet airliner.
PROGRAMME: Japan Aircraft Development Corporation is co-ordinating indigenous designs for a regional jet airliner, with both Kawasaki and Mitsubishi offering competing projects. Kawasaki first showed model of its YPX at Farnborough in July 2006, but has not disclosed further details.



Model of Kawasaki YPX proposed regional airliner (Paul Jackson)

1162253

MITSUBISHI

MITSUBISHI JUKOGYO KABUSHIKI KAISHA (MITSUBISHI HEAVY INDUSTRIES LTD)

Aerospace Administration Department, 16-5 Konan 2-chome, Minato-ku, Tokyo 108-8215
Tel: (+81 3) 67 16 31 11
Fax: (+81 3) 67 16 58 65
Web: www.mhi.co.jp
PRESIDENT: Kazuo Tsukuda
EXECUTIVE VICE-PRESIDENT AND REPRESENTATIVE DIRECTOR/GENERAL MANAGER, AEROSPACE HEADQUARTERS: Nobuo Toda

NAGOYA AEROSPACE SYSTEMS WORKS:
10 Oye-cho, Minato-ku, Nagoya 455-8515
Tel: (+81 52) 611 21 21

Main Nagoya facility (previously known as Nagoya Aircraft Works) was divided in 1989 into Aerospace Systems Works and Guidance & Propulsion Systems Works: former has 346,000 m² (3,724,300 sq ft) of floor space on a 67.3 ha (166.3 acre) site and had an April 2006 workforce of 4,061; latter occupies a 140.4 ha (346.9 acre) site with 84,530 m² (909,900 sq ft) of covered space and had a 1,714 workforce in April 2006. Oye plant manufactures aircraft fuselage components, spacecraft parts and other aero-related equipment; Tobishima plant responsible for aircraft fuselage subassembly, plus assembly and check-out of space systems; fuselage subassembly, final assembly, outfitting, flight test and repair undertaken by Komaki South plant.

Mitsubishi developed the MU-2 utility aircraft, MU-300 business jet and F-2 support fighter, and is currently prime contractor for the F-2 and (Sikorsky) SH/UH-60 helicopter series; Mitsubishi also developed MH2000 helicopter and its MG5 turboshaft engine. Studies under way to evaluate potential successors to UH-60J for production start within 2005-2010 time frame. Previously, company was prime contractor for the T-2 supersonic trainer, F-4EJ Phantom II, F-1 close support aircraft and F-15J/DJ for the JASDF, with Fuji, Kawasaki, Nippi and ShinMaywa as principal subcontractors.

Since 2003, Mitsubishi has been conducting an R&D programme for a future 70/90-seat regional jet under contract from the Japanese Ministry of Economy, Trade and Industry (METI).

Subcontract work includes participation in programmes for the Airbus A319/320 (shroud boxes since 2000), A330/340 (aft cargo doors from 2002), A380 (lower cargo doors: first delivered 2 October 2003); Boeing 737 (flaps); Boeing 747 (wing centre-section and flaps); main deck cargo door for Boeing 747-400 Special Freighter; Boeing 767/777 (fuselage panels and doors); Bombardier Global Express and Challenger 300 (wings); and components for JT8D-200, PW4000, PW6000 and V2500 turbofan engines. Development of composites outer wing boxes for Boeing 787 Dreamliner is under way.

MITSUBISHI F-2

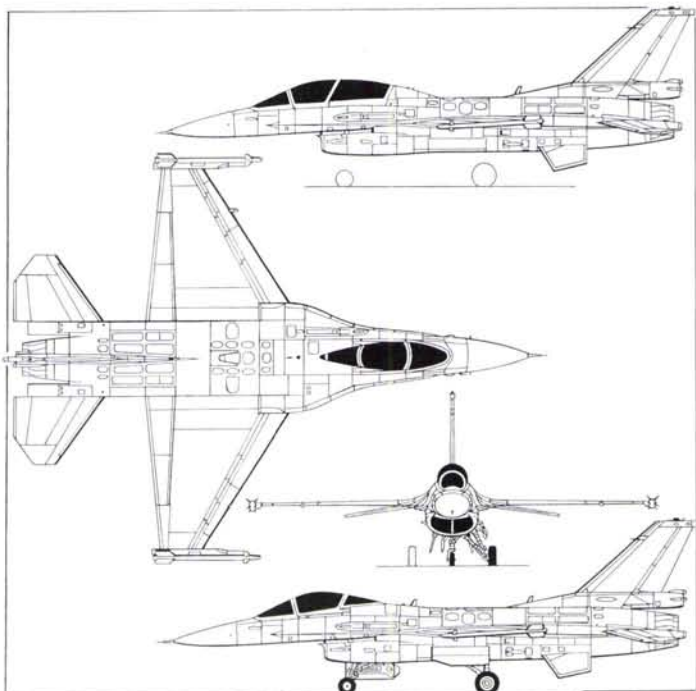
TYPE: Attack fighter.
PROGRAMME: Indigenous design, plus proposals based on F-15, F-16, F/A-18 and Tornado ADV, were originally considered; modified F-16C selected as Japan's FS-X replacement for Mitsubishi F-1 on 21 October 1987. Programme delayed by questions of development sharing with General Dynamics (now Lockheed Martin Aeronautics Company (LMAC)) and technology transfer to Japan, but agreed at Japan 60 per cent and US 40 per cent cost sharing (confirmed November 1988); Mitsubishi appointed prime contractor November 1988; initial contracts awarded for airframe design March 1989 and prototype active phased-array radar February 1990; General Electric F110-GE-129 Improved Performance Engine selected 21 December 1990. First subcontracts to GD let February 1990 for design and development of rear fuselage, wing, leading-edge flaps, avionics and computer-based test equipment. Active phased-array radar, EW (ECM/ESM), mission computer and inertial reference system being developed using Japanese domestic technology.

Japan totally responsible for programme, including all funding; Japanese airframe subcontractors include Kawasaki and Fuji (see Structure). Programme involves four flying prototypes (two single-seat XF-2A first, then two tandem two-seat XF-2B) and two for static and fatigue test; construction began early 1994, final assembly mid-1994; first prototype (single-seat 63-0001) rolled out 12 January 1995; first flight 7 October 1995,



Mitsubishi F-2A attack fighter (Mitsuhiro Kadota)

1158171



Mitsubishi F-2A, with additional side view (top) of two-seat F-2B (Mike Keep)

1158173

followed by second prototype (63-0002) on 13 December 1995; third prototype (63-0003) flew on 18 April 1996 and fourth (63-0004; first in blue colour scheme) on 24 May 1996. Japanese Cabinet approved 130-aircraft programme and allocated F-2 designation on 15 December 1995. Static test airframe (No. '991') under loading trials by 1995.

First XF-2A handed over to JDA on 22 March 1996, followed by '02 on 26 April 1997 and the two XF-2Bs on 9 August and 20 September 1997; prototypes re-serialised 63-8501/02 and 63-8101/02 on 1 December 1997. Congressional approval of US participation in September 1996 followed in October by USD75 million Mitsubishi initial production contract to Lockheed Martin. First Lockheed Martin rear fuselage accepted by Mitsubishi

MITSUBISHI F-2 PROCUREMENT AND DELIVERY(JASDF)

PROCUREMENT					DELIVERY							
FY	Lot	Qty F-2A	F-2B	Cum total F-2A	F-2B	CY	Qty F-2A	F-2B	First aircraft F-2A	F-2B	Cum total F-2A	F-2B
92		1 ¹	0	1	0							
93		1 ¹	2 ¹	2	2							
94												
95												
96	1	7	4	9	6	96	2	2	63-8501	63-8101	2	2
97	2	8	0	17	6	97						
98	3	4	5	21	11	98						
99	4	2	6	23	17	99						
00	5	0	9	23	26	00	6	4	03-8503	03-8103	8	6
01	6	9	3	32	29	01	13	0	13-8509		21	6
02	7	6	2	38	31	02	0	9		23-8107	21	15
03	8	5	1	43	32	03	2	9	33-8522	33-8117	23	24
04	9	3	2	46	34	04	7	5	43-8524	43-8125	30	29
05	10	5	0	51	34	05	4	2	53-8531	53-8130	34	31
06	11	5	0	56	34	06						
07	12	8	0	64	34							

¹ Prototypes: originally numbered 63-0001/02 (XF-2A) and 63-0003/04 (XF-2B)



Two-seat Mitsubishi F-2B

1158172

in November 1998; first licence-built engines delivered by IHI in early 1999. Discovery in May 1998 of wing cracks, and evidence, when flying with two ASM-2 anti-ship missiles, of severe flutter, necessitated modifications to wingtips and pylon attachments, resulting in nine-month slippage of March 1999 scheduled completion date. Flight and static/fatigue testing rescheduled for completion in December 1999 and deliveries for FY99 (three) and FY00 (eight), but further wing crack problems revealed in mid-1999, causing completion of development testing to be extended to 30 June 2000 and first deliveries rescheduled to third quarter 2000. First production F-2A made maiden flight 12 October 1999 and delivered to JASDF on 25 September 2000. Total of 57 production F-2As and F-2Bs delivered by 31 March 2005.

Development of an 'F-2 Super Kai' dedicated air superiority version is under consideration, to replace the F-4EJ Kai, but no decision by mid-2006.

CURRENT VERSIONS: **F-2A:** Single-seat support fighter.

Description applies to F-2A except where indicated.

F-2B: Combat-capable two-seater.

CUSTOMERS: See table. Total of 85 aircraft, including four flying prototypes, ordered by March 2006: eight approved for FY07, JASDF (sole user) originally stated requirement for approximately 72 F-2As to replace F-1s in three support fighter squadrons, plus approximately 50 F-2Bs for OCU and possibly to replace T-2/2A. Plans were to acquire 130 single/two-seaters (83 + 47, reduced from earlier figure of 141 by cancellation of 11 two-seaters); however, in December 2004 JDA decided to curtail this to 98, of which 55 delivered by end of that month.

First recipient originally due to begin conversion in FY99 and to be completely equipped by FY00; however, first delivery (03-8503) not made until 25 September 2000 (formal acceptance 3 October). Six F-2As and eight F-2Bs delivered by year-end: one F-2A temporarily to No. 1 Technical School at Hamamatsu and seven to Rinji F-2 Hikotai (temporary F-2 Squadron) at Misawa, which became 3 Squadron of 3 Wing at same base on 27 March 2001. Remainder of first 45 aircraft allocated to Matsushima OCU (19 Bs). In 2006, 6 Squadron of 8 Wing at Tsukiki will convert from F-1; followed in 2009 by 8 Squadron/3 Wing at Misawa (which, pending F-2s, converted from F-1 to F-4EJ Kai Phantom).

COSTS: Total JDA expenditure (1988 to 1995) USD3.27 billion, including JPY75.7 billion (USD575 million) in FY92 to include first prototype and radar development; further JPY96.5 billion (USD804 million) in FY94 provided for three more flying prototypes and two for ground test. First two Mitsubishi contracts to GD totalled USD280.5 million; follow-on contract to Lockheed (5 February 1993) valued at USD74.2 million. FY96 batch of 11 cost USD1,081.58 million (USD98.32 million per unit); FY97 batch of eight cost USD797.47 million (USD99.68 million per unit); FY00 aircraft cost JPY11.8 billion each. Unit costs of FY01, 02, 03 and 04 were JPY11.15 billion, 12.0 billion, 11.9 billion and 12.34 billion respectively. Corresponding batch totals were JPY133.895 billion, 96.156 billion, 71.534 billion and 61.772 billion.

DESIGN FEATURES: Configuration based on Lockheed Martin F-16. New co-cured composites wing of Japanese design, with greater span, root chord and 25 per cent more area than that of F-16; tapered trailing-edge; slightly longer radome and forward fuselage to house new radar and other mission avionics; longer mid-fuselage and shorter jetpipes; increased-span tailplane; addition of brake-chute; adoption of increased performance engine.

Wing leading-edge sweepback 33° 12'; incidence 0°. Tailplane anhedral 8°.

FLYING CONTROLS: Full-span leading-edge flaps and trailing-edge flaperons; all-moving tailplane; rudder; twin, fixed ventral fins, canted outward 15°. Initially planned vertical canards deleted; CCV functions achieved instead by triple-redundant digital fly-by-wire system, developed jointly by Japan Aviation Electronics and Honeywell. Based on earlier Mitsubishi work with T-2 CCV testbed. Available modes include control augmentation, relaxed static stability, manoeuvre load control, decoupled yaw and manoeuvre enhancement. Single analogue back-up flight control system for three-axis control.

STRUCTURE: Composites structure wing (except leading-edge flaps), horizontal tail, fin (except leading-edge and base), rudder and landing gear doors; other structures also use advanced materials and structure technology, including radar-absorbent material on nose, wing leading-edges and engine intakes; titanium in rear fuselage and tail unit.

Mitsubishi builds forward fuselage and wings; other Japanese airframe companies involved include Fuji (upper wing skins, wing fairings, radome, flaperons, engine air intakes and tail unit) and Kawasaki (fuselage mid-section, mainwheel doors and engine access doors). Lockheed Martin providing rear fuselage, 80 per cent of all port-side wing boxes, all leading-edge flaps, avionics systems, stores management systems and some test equipment; first LM production rear fuselage accepted 10 November 1998; first wing box delivered March 1999.

LANDING GEAR: Retractable tricycle type, with single wheel on each unit; mainwheels retract inward, nosewheel rearward. Mainwheel tyres size 27.75x8.75R145, pressure 22.06 bar (320 lb/sq in); nosewheel tyre size 18x5.7-8, pressure 20.69 bar (300 lb/sq in). Brake-chute in fairing at base of rudder.

POWER PLANT: One General Electric F110-GE-129 turbofan (131.2 kN; 29,500 lb st with afterburning), licence-built by IHI for production aircraft. Maximum internal fuel capacity 4,637 litres (1,225 US gallons; 1,020 Imp gallons), of which 4,588 litres (1,212 US gallons; 1,009 Imp gallons) are usable; reduced to 3,948 litres (1,043 US gallons; 868.5 Imp gallons), of which 3,903 litres (1,031 US gallons; 858.5 Imp gallons) usable, in F-2B. Maximum external fuel capacity (both) 5,678 litres (1,500 US gallons; 1,249 Imp gallons) (one 1,135.5 litre; 300 US gallon; 249.8 Imp gallon and two 2,271.25 litre; 600 US gallon; 499.6 Imp gallon tanks). In-flight refuelling receptacle on top of centre-fuselage.

ACCOMMODATION: One pilot in F-2A, two in tandem in F-2B, in pressurised and air-conditioned cockpit(s). Boeing ACES II ejection seat(s). Upward-opening canopy with separate windscreens.

SYSTEMS: Shimadzu/Honeywell environmental control system uses engine bleed air for pressurisation and cooling of crew stations and avionics compartment. Tokyo Aircraft Instruments/Carlton onboard oxygen generation system (OBOGS).

AVIONICS: *Comms:* Raytheon AN/ARC-164 Have Quick UHF transceiver; NEC V/UHF

transceiver; Tokyo Radio System/BAE AIFF; Hitachi Kokusai Electric HF radio.

Radar: Mitsubishi Electric active phased-array radar.

Flight: Japan Aviation Electronics/Honeywell digital AFCS; Japan Aviation Electronics ring laser IRS; Toshiba VOR/ILS; Rockwell Collins Tacan.

Instrumentation: Shimadzu wide-angle holographic HUD with raster video capability. Koito integrated control panel. Yokogawa 137 x 137 mm (5.4 x 5.4 in) colour LCD MFD, two 108 x 108 mm (4.25 x 4.25 in) MFDs and an LCD standby display.

Mission: Mitsubishi Electric mission computer. Mitsubishi MDS mission planning system; Toshiba digital map display system.

Self-defence: Mitsubishi Electric integrated EW system.

ARMAMENT: One internal M61A2 Vulcan 20 mm multibarrel gun in port wingroot, plus 13 external stores stations: Sta 6 on centreline; Sta 1 (port) and 11 at each wingtip; and five under each wing (Sta 2, 3, 4L, 4, 5, 8, 8R, 9 and 10); AIM-7F/M Sparrow medium-range air-to-air missiles (Sta 2 and 10); AIM-9L or Mitsubishi AAM-3 air-to-air missiles (Sta 1, 2, 10 and 11) and ASM-1 and ASM-2 anti-shiping missiles (Sta 3, 4, 8 and 9); 500 lb general purpose bombs (Sta 4L and 8R); CBU-87/B cluster bombs (Sta 4 and 8); and JLAU-3/A or RL-4 rocket launchers (Sta 4 and 8). Centreline and inboard underwing stations (5, 6 and 7) wet for carriage of external tanks.

DIMENSIONS, EXTERNAL:

Wing span: over missile rails	11.125 m (36 ft 6 in)
excl missile rails	10.80 m (35 ft 5 1/4 in)
Wing chord: at root	5.27 m (17 ft 3 1/2 in)
at tip	1.185 m (3 ft 10 1/4 in)
Wing aspect ratio	3.3
Length overall	15.52 m (50 ft 11 in)
Height overall	4.96 m (16 ft 3 1/4 in)
Tailplane span	6.045 m (19 ft 10 in)
Wheel track	2.36 m (7 ft 9 in)
Wheelbase	4.05 m (13 ft 3 1/2 in)

AREAS:

Wings, gross	34.84 m ² (375.0 sq ft)
Leading-edge flaps (total)	4.70 m ² (50.59 sq ft)
Flaperons (total)	3.96 m ² (42.63 sq ft)
Fin, incl dorsal fin	4.00 m ² (43.06 sq ft)
Rudder	1.08 m ² (11.63 sq ft)
Ventral fins (total)	1.50 m ² (16.15 sq ft)
Horizontal tail surfaces (total)	7.05 m ² (75.89 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: F-2A	9,527 kg (21,003 lb)
F-2B	9,633 kg (21,237 lb)
T-O weight:	
clean: F-2A	13,459 kg (29,672 lb)
F-2B	13,230 kg (29,167 lb)
with two short-range AAMs:	
F-2A	13,713 kg (30,232 lb)
F-2B	13,412 kg (29,568 lb)
with four short-range and four medium-range AAMs:	
F-2A	15,711 kg (34,637 lb)
F-2B	15,392 kg (33,934 lb)
with two short-range AAMs, six 500 lb bombs and two drop tanks:	
F-2A	19,888 kg (43,845 lb)
F-2B	19,569 kg (43,142 lb)
with two short-range AAMs, four anti-ship missiles and two drop tanks:	
F-2A	20,517 kg (45,232 lb)
F-2B	20,198 kg (44,529 lb)

Design max T-O weight with external stores:

F-2A, F-2B	22,100 kg (48,722 lb)
------------	-----------------------

Design max landing weight:

F-2A, F-2B	18,300 kg (40,345 lb)
------------	-----------------------

Design max wing loading

	634.3 kg/m ² (129.92 lb/sq ft)
--	---

Design max power loading

	168 kg/kN (1.65 lb/lb st)
--	---------------------------

PERFORMANCE (F-2A):

Design max level speed: at high altitude

at low altitude	approx M2.0
-----------------	-------------

Typical combat radius:

F-2A	more than 450 n miles (833 km; 518 miles)
------	---

MITSUBISHI (SIKORSKY) SH-60

JMSDF designations: SH-60J and SH-60K

TYPE: Naval combat helicopter.

PROGRAMME: Detail design of S-70B-3 version of Sikorsky SH-60B Seahawk (see US section), to meet JMSDF requirements, started August 1983; Japanese avionics and equipment integrated by Technical Research and Development Institute (TRDI) of JDA. First flight of first of two XSH-60J prototypes (8201), based on imported airframes, 31 August 1987; evaluation by 51st Air Development Squadron of JMSDF at Atsugi completed early 1991; first production SH-60J (8203) flown 10 May 1991, delivered 26 August.

CURRENT VERSIONS: SH-60J: Initial Japanese production version; *as described*.

SH-60K: Following trials begun by TRDI in 1995 on an all-composites rotor system with redesigned planforms and tips, offering increase in hovering efficiency and vibration reduction. FY97 budget requested funding for first prototype (then known as SH-60Kai or XSH-60K), upgraded with new main rotor hub and blades, increased cabin cross-section (33 cm; 13 in longer and 15 cm; 6 in more headroom), active dipping sonar, a tactical data processing and display system, and a laser-based shipboard automatic landing system. First of two prototypes (8401) eventually rolled out 8 August 2001 and made its first hovering flight on 9 August. Both delivered to JMSDF 24 June 2002 for technical and operational evaluation, which continued to end of March 2005. First production SH-60K (8403) delivered on 10 August 2005.

CUSTOMERS: See table. JMSDF requirement for about 100 SH-60Js; 103 ordered, of which more than 80 in service, by 1 April 2002; half of force land-based. Three new aircraft approved in FY01 to offset delays in SH-60K programme. SH-60Js operated by Nos. 101, 121 and 123 Squadrons (at Tateyama); Nos. 122 and 124 (at Ohmura); No. 211 (training unit at Kanoya); squadron at Komatsushima undergoing conversion in 2001.

Seven SH-60Ks approved in each of FYs 02, 03 and 04; further seven approved for FY05 and five for FY06; five more approved for FY07. Total of 44 planned. At least five delivered by late 2005.

COSTS: Unit cost JPY5.07 billion (2000).

POWER PLANT: T700-401C engines (-401C2 in SH-60K) manufactured by IHI.

ACCOMMODATION: Crew of three plus nine systems operators/observers.



Second production Mitsubishi SH-60K (Miatsuhiro Kadota)

1158174

MITSUBISHI SH-60 PROCUREMENT(JMSDF)

SH-60J				SH-60K		
FY	Qty	First aircraft	Cum total	Qty	First aircraft	Cum total
82	1 ¹	8201	1			
83	1 ¹	8202	2			
88	12	8203	14			
89	12	8215	26			
90	11	8227	37			
91	5	8238	42			
92	7	8243	49			
93	4	8250	53			
94	5	8254	58			
95	6	8259	64			
96	6	8265	70			
97	7	8271	77	1 ²	8401	1
98	7	8278	84	1 ²	8402	2
99	9	8285	93			
00	7	8294	100			
01	3	8301	103			
02				7	8403	9
03				7	8410	16
04				7	8417	23
05				7		30
06				5		35
07				5		40
Total	103		103	40		40

¹ Sikorsky-built XSH-60Js
² SH-60K prototypes

AVIONICS (SH-60J): Radar: Japanese HPS-105 search radar.
Flight: Japanese automatic flight management system and ring laser gyro AHRs.
Instrumentation: Japanese controls and displays subsystem, datalink and tactical data processor.
Mission: Japanese HQS-104 sonar; Raytheon AN/ASQ-81D(V)4 MAD: Japanese HRR-1 sonobuoy receiver.
Self-defence: Japanese HLR-108C ESM. Some aircraft equipped with chaff/flare dispensers.
AVIONICS (SH-60K): Include Kanto (Smiths licence) enhanced flight data recorder; advanced helicopter combat direction system (AHCDS: sensors for ocean stream, water temperature and submarine topography); datalink system; tactical estimation support capability; and automatic ship landing assistance system.
EQUIPMENT: RAST, sonobuoys, rescue hoist and cargo sling.
ARMAMENT (SH-60J): Some being equipped with 7.62 mm machine guns for self-protection against terrorist attacks.
ARMAMENT (SH-60K): Anti-shiping missiles and gun.

MITSUBISHI (SIKORSKY) UH-60

JASDF/JMSDF designation: UH-60J
JGSDF designation: UH-60JA
TYPE: Medium transport helicopter.
PROGRAMME: Detail design to Japanese requirements started April 1988; one US-built S-70A-12 imported, followed by two CKD kits for licence assembly (first flight 20 December 1989 at Sikorsky; delivered to JASDF 28 February 1991; second kit aircraft first flew February 1990, delivered to JASDF 29 March 1991). Remainder being built in Japan.
CURRENT VERSIONS: UH-60J: Standard search and rescue version for JASDF and JMSDF; can fly one hour search at 250 n miles (463 km; 288 miles) from base.
UH-60JA: JGSDF version; navigation/weather radar and FLIR night and adverse weather vision system. First (43101) completed late 1997; initial deliveries (four) January 1998.
CUSTOMERS: See table. JASDF has total requirement for 46 UH-60Js, JMSDF for 19; total of 26 in service with JASDF and 18 with JMSDF by 1 March 2003. JASDF aircraft operated by detached flights of Air Rescue Wing (HQ: Iruma); JMSDF UH-60Js to Atsugi Rescue Squadron in 1992; subsequently Kanoya, Tokushima, Shimofusa and Hachinohe.
JGSDF plans to procure up to 80 UH-60JAs in a US\$2.67 billion programme announced early 1995; procurement began that year; JGSDF will deploy 50 with five district helicopter units alongside UH-1Js, with balance assigned to VIP transport and training; six delivered by 1 April 1999, this remaining as inventory total on 1 April 2000, despite more then awaiting acceptance. First two units are Nos. 1 and 12 Squadrons.
FY06 budget included two for JASDF and one for JGSDF; two J and one JA approved for FY07.



JASDF Mitsubishi UH-60J (Mitsuhiro Kadota)

1158175



Low visibility colour scheme applied to JASDF Mitsubishi UH-60J delivered in 2005 (Mitsuhiro Kadota)

1158176

COSTS: Unit costs in FY00 were JPY3.37 billion for UH-60JA and JPY3.6 billion for air force UH-60J.
POWER PLANT: T700-401C turboshafts manufactured by IHI.
ACCOMMODATION: Crew of four (JMSDF) or five (JASDF) plus up to 11 other persons. Bubble windows for pilot and on each side at front of main cabin.
AVIONICS: Radar: Nose-mounted Honeywell search/weather radar.

MITSUBISHI UH-60 PROCUREMENT							
FY	UH-60J (JASDF)	First aircraft	UH-60J (JMSDF)	First aircraft	UH-60JA (JGSDF)	First aircraft	Cum total
88	3 ¹	18-4551					3
89	2	28-4554	3	8961			8
90	2	28-4556					10
91	4	38-4558	3	8964			17
92	2	58-4562	2	8967			21
93	1	68-4564	2	8969			24
94	2	68-4565	1	8971			27
95	2	78-4567	1	8972	2	43101	32
96	1	98-4569	2	8973	4	43103	39
97	3	08-4570	2	8975	4	43107	48
98	2	08-4573	2	8977	5	43111	57
99	2	18-4575			3	43116	62
00	2	28-4577			3	43119	67
01	2	48-4579	1	8979	2	43122	72
02	1	58-4581			2	43124	75
03	2	68-4582			1	43126	78
04	2	78-4584			1	43127	81
05	2	78-4586			1	43128	84
06	2				1		
07	2				1		
Totals	41		19		30		90

¹ One Sikorsky-built, two Mitsubishi-assembled from CKD kits

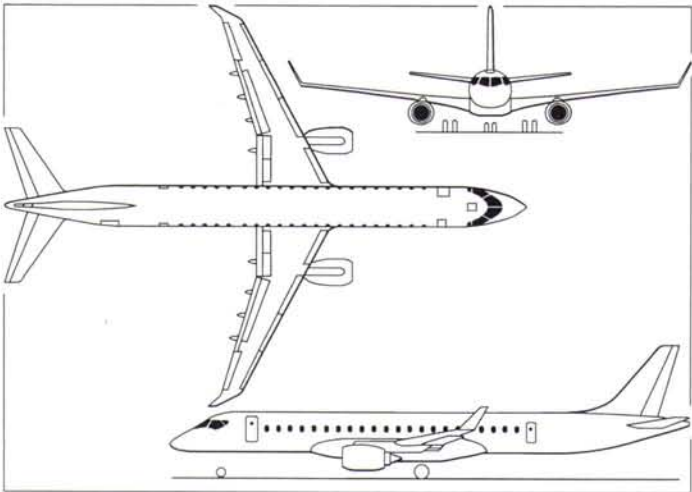
Flight: Japanese self-contained navigation system.
Mission: Turret-mounted Raytheon FLIR beneath nose.
EQUIPMENT: Rescue hoist, ETS (external tank support) system, and hook for cargo sling.

MITSUBISHI NGRJ

TYPE: Regional jet airliner.
PROGRAMME: Japan Aircraft Development Corporation is co-ordinating indigenous designs for a next-generation regional jet (NGRJ) airliner, with both Kawasaki and Mitsubishi offering competing projects. First provisional details of Mitsubishi design revealed in 2004, then as T-tailed, rear-engined design (two 30.7 kN; 6,900 lb st class turbofans) in 30-passengers class. By 2006, this had transmuted into stretched-fuselage, low-tailed design with underwing podded engines and aimed at 70/90-passenger market. Late 2006 was planning to fix engine, avionics and equipment configurations by March 2007, leading to launch in 2008 (given appropriate support from industrial partners) and certification in 2012.
CURRENT VERSIONS: Projected as MJ-70 and MJ-90, indicating approximate passenger capacity.
DESIGN FEATURES: See accompanying illustrations.
Following data all provisional:
POWER PLANT: Two "brand new" (sic) turbofans, pod-mounted under wings; each 57.8 kN (13,000 lb st) in MJ-70, 66.3 kN (14,900 lb st) in MJ-90. Rolls-Royce and General Electric showing interest in participation.
DIMENSIONS, EXTERNAL (MJ-90):
Wing span over winglets 28.9 m (94.8 ft)
Length overall 35.0 m (114.8 ft)



Revised (2006) appearance of Mitsubishi's next generation RJ 1162251



Provisional (2006) general arrangement of Mitsubishi's MJ-90 proposed NGRJ next-generation regional jet (Paul Jackson) 1158266
Height overall 9.8 m (32.2 ft)
Door height to sill: fwd 2.4 m (7.9 ft)
rear 2.7 m (8.9 ft)
WEIGHTS AND LOADINGS:
Operating weight empty: MJ-70 22,680 kg (50,000 lb)
MJ-90 23,905 kg (52,700 lb)
Max T-O weight: MJ-70 38,283 kg (84,400 lb)
MJ-90 42,093 kg (92,800 lb)
Max landing weight: MJ-70 34,500 kg (76,060 lb)
MJ-90 37,900 kg (83,555 lb)
PERFORMANCE:
Normal cruising speed (both) M0.78
Max operating altitude (both) 11,880 m (39,000 ft)
T-O field length: MJ-70 1,740 m (5,710 ft)
MJ-90 1,820 m (5,970 ft)
Landing field length at MLW: MJ-70 1,410 m (4,630 ft)
MJ-90 1,490 m (4,890 ft)
Design range, typical payload (both) 1,950 n miles (3,611 km; 2,244 miles)

SHINMAYWA

SHINMAYWA KOGYO KABUSHIKI KAISHA
(SHINMAYWA INDUSTRIES LTD)
1-1 Shinmeiwa-cho, Takarazuka, Hyogo 665-8550
Tel: (+81 798) 56 50 00
Fax: (+81 798) 56 50 01
e-mail: head@sa.shinmaywa.co.jp
Web: www.shinmaywa.co.jp
CHAIRMAN: Shiko Saikawa
PRESIDENT: Jushi Ide

Aircraft Division
1-1 Ohgi 1-chome, Higashinada-ku, Kobe 658-0027
Tel: (+81 78) 412 91 51
Fax: (+81 78) 431 36 95
e-mail: air.sales@shinmaywa-air.com
EXECUTIVE OFFICER AND GENERAL MANAGER: Seiichi Yasumoto
DEPUTY GENERAL MANAGER: Isao Takemura
WORKS: Konan Plant (Kobe) and Tokushima Plant

SALES OFFICES:
Business Development and Contract Head Office:
3-2-43 Shitte, Tsurumi-ku, Yokohama-shi, Kanagawa 230-0003
Tel: (+81 45) 575 79 00

Fax: (+81 45) 575 79 01
DIRECTOR: Motoaki Nishimoto

Defence Programme, Business Development and Contract Head Office:
Tel: (+81 45) 575 79 00
Fax: (+81 45) 575 79 01
GENERAL MANAGER: Yasuo Kawanishi

Commercial Programme, Business Development and Contract Head Office:
1-1 Ohgi 1-chome, Higashinada-ku, Kobe 658-0027
Tel: (+81 78) 412 91 51
Fax: (+81 78) 435 20 22
GENERAL MANAGER: Motoaki Nishimoto

Former Kawanishi Aircraft Company (established November 1928); became Shin Meiwa in November 1949 and renamed ShinMaywa Industries in June 1992; major overhaul centre for Japanese and US military and commercial aircraft. Principal activities are production and/or upgrading of US-1A for JMSDF, and overhaul work on amphibians; upgraded US-1AKai made maiden flight in December 2003 and now being offered for export.

Manufactures wing trailing-edges and external drop tanks for Mitsubishi F-2; tailplanes for Mitsubishi-built SH-60J and K; internal cargo handling system for Kawasaki-built CH-47JA; wingroot fillet fairings and ramp skins for Airbus A380; fixed trailing-edges for Boeing 767, under subcontract to Vought; design and manufacture of wing/body fairings for Boeing 777. Support centre for U-36A (Learjet 36A); maintenance and technical support for JASDF U-4

(Gulfstream IV) since 1996; manufacture of control surfaces, wing/body fairing, mainwheel doors and fairings, and radome, for Gulfstream V/500/550.

SHINMAYWA US-1A and US-2

TYPE: Four-turboprop amphibian.
PROGRAMME: First flown 16 October 1974; first delivery (as US-1) 5 March 1975 (see 1985 86 *Jane's All the World's Aircraft*); all now have T64-IHI-10J engines as US-1As. Upgrade of original design (as US-1AKai) began 1 November 1996; redesignated US-2 in late 2004. ShinMaywa seeking government approval in 2005-06 to develop a commercial firefighting version of US-2 with a 15-ton capacity internal water tank. A 38/42-passenger version has also been proposed. These civil versions now being actively promoted, with marketing assistance from 2006 by JADC.
CURRENT VERSIONS: **US-1A:** SAR amphibian, developed from PS-1 ASW flying-boat; manufacturer's designation **SS-2A**.

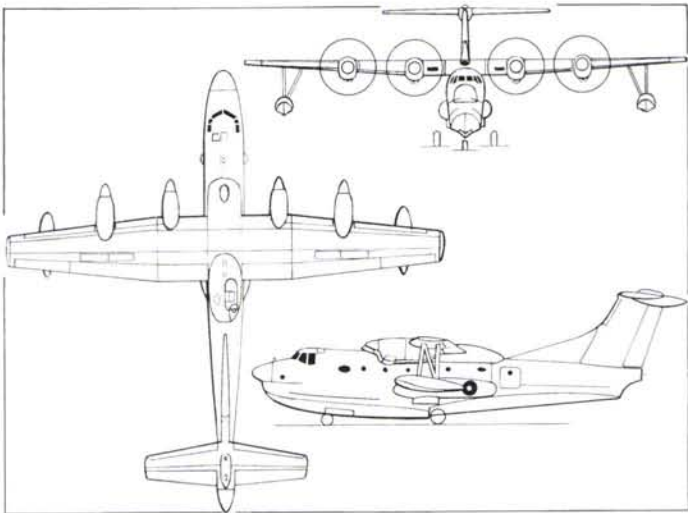
Data apply to US-1A except where indicated.
US-2: Rolls-Royce AE 2100J turboprops, six-blade Smiths Aerospace propellers, modified wing with integral fuel tanks and composites floats, pressurised upper hull, FBW controls, 'glass cockpit', Thales Ocean Master radar, Honeywell RE-220 APU and LHTEC CTS800-based BLC compressor. Expected performance enhancements include maximum speed of 300 kt (555 km/h; 345 mph), service ceiling greater than 6,100 m (20,000 ft), extended range and a 50 per cent reduction in take-off distance on water.
Parts manufacture for first aircraft began in April 2000; major assembly started 3 July 2001; static and fatigue test airframes completed; former began testing in 2002, latter started in 2003; due to conclude in March 2005 and early 2006 respectively. First prototype (9901) rolled out 22 April 2003; first flight achieved on 18 December 2003; handed over to JMSDF's 51st Air Wing at Iwakuni 24 March 2004, for 27-month test programme. Second aircraft flew 30 June 2004 and handed over to 51st AW in December. Both planned to be brought up to production standard for 2008 service entry. Service entry planned 2007, replacing US-1As, which will be retired.

Firefighting amphibian: PS-1 modified in 1976 to firefighting configuration; 7,348 kg (16,200 lb) capacity water tank in centre-fuselage forward of step. One US-1A modified experimentally in 1986 to 1988, with more than 13,608 kg (30,000 lb) tank capacity; details in earlier editions. No orders by mid-2006, but promotion continues.
CUSTOMERS: Total of 20 US-1/1As ordered, last of which delivered 23 February 2005. Orders since 1988 have been for attrition replacements and, more recently, due to phase-out of older aircraft. No. 71 SAR Squadron of the JMSDF maintains fleet structure of seven aircraft at Iwakuni and Atsugi bases.
JMSDF said to have requirement for 14 US-2s to replace existing US-1A fleet; JDA expected to request up to seven subject to successful completion of flight test programme; first one included in FY07 budget. First unit will be 71st Air Wing.

US-1 AND US-2 PROCUREMENT (JMSDF)

FY	Qty	Cum Total
72	1	1
73	2	3
77	1	4
78	2	6
79	1	7
80	1	8
82	1	9
83	1	10
84	1	11
88	1	12
92	1	13
93	1	14
95	1	15
96	1	16
97	1	17
99	1	18
01		18
02	1	19
04	1	20
05	1	21
06	1	22
07	1	23

COSTS: US-2 development costs estimated at JPY66 billion (USD630 million) in 1996.
DESIGN FEATURES: Large turboprop-powered amphibian, suitable for maritime patrol and sea rescue missions. Boundary layer control system and extensive flaps for propeller slipstream deflection for very low landing and take-off speeds; low-speed control and stability enhanced by blowing rudder, flaps and elevators, and by use of automatic flight control system (see Flying Controls). Fuselage high length/beam ratio; V-shaped single-step



ShinMaywa US-2 (US-1AKai) SAR amphibian (James Goulding)

1158178

planing bottom, with curved spray suppression strakes along sides of nose and spray suppressor slots in lower fuselage sides aft of inboard propeller line; double-deck interior. Large dorsal fin.
FLYING CONTROLS: Digital flight control system controlling elevators, rudder and outboard flaps. Hydraulically powered ailerons, elevators (with tabs) and rudder, all with feel trim. High-lift devices include outboard leading-edge slats over 17 per cent of wing span and large outer and inner blown trailing-edge flaps deflecting 60° and 80° respectively; outboard flaps can be linked with ailerons; inboard flaps, elevators and rudder blown by Mitsubishi BLC system. Spoiler in front of outer flap on each wing. Inverted slats on tailplane leading-edge.

STRUCTURE: Wings built by Fuji, fuselage by ShinMaywa and floats by Showa (Mitsubishi, Kawasaki and Nippi co-operated with ShinMaywa for US-2).

LANDING GEAR: Flying-boat hull, plus hydraulically retractable Sumitomo tricycle landing gear with twin wheels on all units. Steerable nose unit. Oleo-pneumatic shock-absorbers. Main units, which retract rearward into fairings on hull sides, have 40x14 22 tyres, pressure 7.79 bar (113 lb/sq in). Nosewheel tyres size 25x6.75 18, pressure 20.69 bar (300 lb/sq in). Three-rotor hydraulic disc brakes. No anti-skid units. Minimum ground turning radius 18.80 m (61 ft 8 3/4 in) towed, 21.20 m (69 ft 6 3/4 in) self-powered.

POWER PLANT: **US-1A:** Four 2,535 kW (3,400 shp) Ishikawajima-built General Electric T64-IHI-10J turboprops, each driving a Sumitomo-built Hamilton Sundstrand 63E60-27 three-blade constant-speed reversible-pitch propeller.

US-2: Four 3,356 kW; (4,500 shp) Rolls-Royce AE 2100J turboprops, with FADEC and six-blade Dowty R414 propellers.

Fuel (both) in five wing tanks, with total usable capacity of 11,640 litres (3,075 US gallons; 2,560.5 Imp gallons) and two fuselage tanks (10,849 litres; 2,866 US gallons; 2,386.5 Imp gallons); total usable capacity 22,489 litres (5,941 US gallons; 4,947 Imp gallons). Pressure refuelling point on port side, near bow hatch. Oil capacity 152 litres (40.2 US gallons; 33.4 Imp gallons). Aircraft can be refuelled on open sea, either from surface vessel or from another US-1A with detachable at-sea refuelling equipment.

ACCOMMODATION: Crew of three on flight deck (pilot, co-pilot and flight engineer), plus navigator, radio/radar operator and medical attendant's seats in main cabin. Latter can accommodate up to 20 seated survivors or 12 stretchers, one auxiliary seat and two observers' seats. Sliding rescue door on port side of fuselage, aft of wing.

SYSTEMS: Cabin air conditioning system. Two independent hydraulic systems, each 207 bar (3,000 lb/sq in). No. 1 system actuates ailerons, outboard flaps, spoilers, elevators, rudder and control surface feel; No. 2 system actuates ailerons, inboard and outboard flaps, wing leading-edge slats, elevators, rudder, landing gear extension/retraction and lock/unlock, nosewheel steering, mainwheel brakes and windscreen wipers. Emergency system, also of 207 bar (3,000 lb/sq in), driven by 24 V DC motor, for actuation of inboard flaps, landing gear extension/retraction and lock/unlock, and mainwheel brakes.

Honeywell 85-131J APU (RE-220 in US-1AKai) provides power for starting main engines and shaft power for 40 kVA emergency AC generator. Boundary layer control (BLC) system includes a C-2 compressor, driven by a 1,119 kW (1,500 shp) Ishikawajima-built General Electric T58-IHI-10-M2 gas turbine, housed in upper centre portion of



Second prototype ShinMaywa US-2

1158177

fuselage, which delivers compressed air at 14 kg (30.9 lb)/s and pressure of 1.86 bar (27 lb/sq in) for ducting to inner and outer flaps, rudder and elevators (US-2 has LHTEC CTS800-4K turbine).

Electrical system includes 115/200 V three-phase 400 Hz constant-frequency AC and three transformer-rectifiers to provide 28 V DC. Two 40 kVA AC generators, driven by Nos. 2 and 3 main engines. Emergency 40 kVA AC generator driven by APU. DC emergency power from two 24 V 34 Ah Ni/Cd batteries.

De-icing of wing and tailplane leading-edges. Oxygen system for all crew and stretcher stations. Fire detection and extinguishing systems standard.

AVIONICS: Commis: HRC-121 HF, HRC-113 VHF and HRC-115-1 U/VHF radios; HIC-3B interphone; AN/APX-68-NB IFF transponder; RRC-22 emergency transmitter.

Radar: Thales OM-100 Ocean Master search radar.

Flight: HRN-101 ADF; OA-8697A/ARD UHF/DF; AN/ARN-118(V)2 Tacan; HRN-115-5 GPS nav system; HRN-107B-1 VOR/ILS receiver; AN/APN-171 (N2) radio altimeter; HPN-101B wave height meter; HSN-4 INS; N-TR-45 TAS transmitter; HRA-6-3 nav display; and N-ID-66/HRN BDHI.

EQUIPMENT: Marker launcher, 10 marine markers, six green markers, two droppable message cylinders, 10 float lights, pyrotechnic pistol, parachute flares, two flare storage boxes, binoculars, two rescue equipment kits, two droppable liferaft containers, rescue equipment launcher, lifeline pistol, lifeline, three lifebuoys, loudspeaker, hoist unit, rescue platform, lifeboat with outboard motor, camera, and 12 stretchers. Sea anchor in nose compartment. Stretchers can be replaced by troop seats.

DIMENSIONS, EXTERNAL:

Wing span	33.15 m (108 ft 9 in)
Wing chord: at root	5.00 m (16 ft 4 3/4 in)
at tip	2.39 m (7 ft 10 in)
Wing aspect ratio	8.1
Length overall	33.46 m (109 ft 9 3/4 in)
Height overall	9.95 m (32 ft 7 3/4 in)
Tailplane span	12.36 m (40 ft 8 1/2 in)
Wheel track	3.56 m (11 ft 8 1/4 in)
Wheelbase	8.33 m (27 ft 4 in)
Propeller diameter	4.42 m (14 ft 6 in)
Rescue hatch (port side, rear fuselage):	
Height	1.58 m (5 ft 2 1/4 in)
Width	1.46 m (4 ft 9 1/2 in)

AREAS:

Wings, gross	135.82 m ² (1,462.0 sq ft)
Ailerons (total)	6.40 m ² (68.90 sq ft)
Inner flaps (total)	9.40 m ² (101.18 sq ft)
Outer flaps (total)	14.20 m ² (152.85 sq ft)

Leading-edge slats (total)	2.64 m ² (28.42 sq ft)
Spoilers (total)	2.10 m ² (22.60 sq ft)
Fin	17.56 m ² (189.0 sq ft)
Dorsal fin	6.32 m ² (68.03 sq ft)
Rudder	7.01 m ² (75.50 sq ft)
Tailplane	23.04 m ² (248.00 sq ft)
Elevators, incl tabs	8.78 m ² (94.50 sq ft)

WEIGHTS AND LOADINGS (search and rescue):

Manufacturer's weight empty	23,300 kg (51,367 lb)
Weight empty, equipped	25,630 kg (56,505 lb)
Usable fuel: JP-4	17,518 kg (38,620 lb)
JP-5	18,397 kg (40,560 lb)
Max oversea operating weight	36,000 kg (79,365 lb)
Max T-O weight: from water	43,000 kg (94,800 lb)
from land	45,000 kg (99,200 lb)
Max wing loading	331.3 kg/m ² (67.85 lb/sq ft)
Max power loading	4.24 kg/kW (6.97 lb/shp)

PERFORMANCE (search and rescue, land T-O. A: at 36,000 kg; 79,365 lb weight, B: at 43,000 kg; 94,800 lb, C: at max T-O weight):

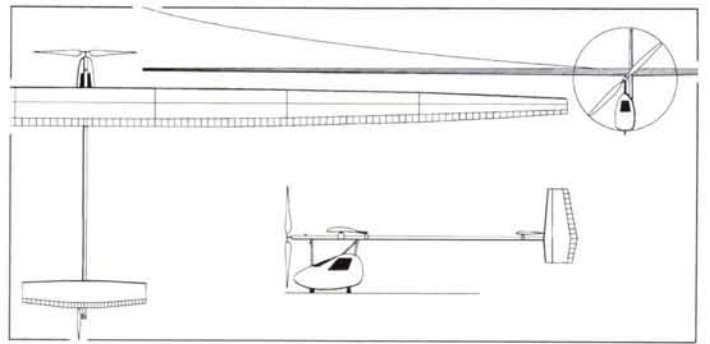
Max level speed: C	276 kt (511 km/h; 318 mph)
Max level speed at FL100:	
A	282 kt (522 km/h; 325 mph)
Cruising speed at FL100:	
C	230 kt (426 km/h; 265 mph)
Max rate of climb at S/L: A	713 m (2,340 ft)/min
C	488 m (1,600 ft)/min
Service ceiling: A	8,655 m (28,400 ft)
C	7,195 m (23,600 ft)
T-O to 15 m (50 ft) on land, 30° flap, BLC on (ISA):	
C	655 m (2,150 ft)
T-O distance on water, 40° flap, BLC on (ISA):	
B	555 m (1,820 ft)
Landing from 15 m (50 ft) on land, AUW of 36,000 kg (79,365 lb), 40° flap, BLC on, with reverse pitch:	
A	810 m (2,655 ft)
Landing distance on water, AUW of 36,000 kg (79,365 lb), 60° flap, BLC on:	
A	220 m (720 ft)
Runway LCN requirement: B	42
Max range at 230 kt (426 km/h; 265 mph) at FL100	2,060 n miles (3,815 km; 2,370 miles)

TIT
TOKYO INSTITUTE OF TECHNOLOGY
2-12-1 Ookayama, Meguro-ku, Tokyo 152-8550
Tel: (+81 3) 57 34 29 75
Fax: (+81 3) 57 34 36 61
PRESIDENT: Masuo Aizawa
EXECUTIVE VICE-PRESIDENT, RESEARCH: Akira Shimokohbe

On 19 July 2006, electrical goods manufacturer Panasonic announced that, three days earlier, an aircraft had made the world's first manned flight powered entirely by dry cell batteries. The flight, made from Okegawa Airport north of Tokyo, was the outcome of the Oxyride Dry Cell Manned Flight Project, a joint programme begun in January 2006 by Panasonic and the Tokyo Institute of Technology (TIT).

The aircraft was based on five years of development by the 'Meister' club (www.meister.ne.jp) club of TIT students specialising in innovative solutions not restricted to aviation. The same machine, then powered by its pilot alone, had participated in the propeller-driven section of the 29th Human Bird Contest on 17 July 2005, coming third. Man-powered development was continuing in 2007.

Panasonic's Oxyride battery derives its name from the use of oxyhydroxide, which releases a higher initial voltage than traditional alkaline batteries, combined with proprietary vacuum-pouring technology that allows more electrolytes to be inserted into the battery. A total of 160 of the AA-size units was used to power the test aircraft, a former single-seat man-powered ultralight with a 31 m (101.7 ft) wing span and a weight of just 54 kg (119 lb). Following



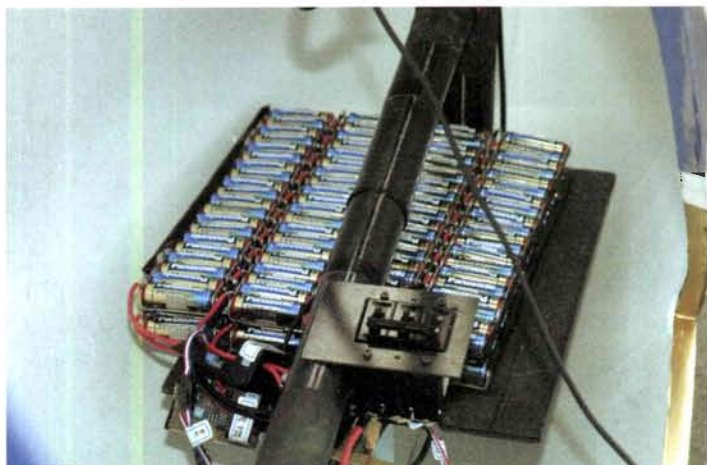
Man- or battery-powered aircraft designed and built by 'Meister' club of Tokyo Institute of Technology (Paul Jackson) 1158761

completion and roll-out in April 2006, it was piloted for the 59-second historic flight on 16 July by Tomohiro Kamiya, a 53 kg (117 lb) TIT student. The aircraft flew a distance of 391.4 m (1,284 ft) at an altitude of 5.2 m (17 ft), and was monitored by the Japan Aeronautic Association for later submission to the FAI for recognition as an official record. A second



A moment of aviation history as TIT man-powered aircraft flies on battery power only

1158870



The 160-battery Oxiride dry cell power pack

1158871

flight was made later, using only 96 of the Oxiride batteries. On this occasion, the aircraft flew for 269 m (882.5 ft) at an altitude of 2 m (6.6 ft).

TIT MAN-POWERED AIRCRAFT

TYPE: Technology demonstrator.

DESIGN FEATURES: Tailplane incidence $\pm 10^\circ$.

STRUCTURE: Wing spar and fuselage boom of CFRP.

DIMENSIONS, EXTERNAL:

Wing span (before 2006 modifications)	29.25 m (95 ft 11½ in)
Wing chord: at root	1.17 m (3 ft 10 in)
at tip	0.45 m (1 ft 5¾ in)



Tokyo Institute of Technology man-powered aircraft in 2005, with winglets

1158865

Wing deflection under load	1.90 m (6 ft 2¾ in)
Length: pod	2.09 m (6 ft 10¼ in)
overall	8.94 m (29 ft 4 in)
Height overall, propeller turning	3.28 m (10 ft 9 in)
Tailplane span	3.75 m (12 ft 3½ in)
Propeller diameter	3.15 m (10 ft 4 in)
Propeller ground clearance	0.26 m (10¼ in)

Jordan

JAI

JORDAN AEROSPACE INDUSTRIES

Shmeisani, Sh Nasser bin Jameel Street, Building No 23 FL 1, PO Box 815570, Amman 11180

Tel: (+962 6) 556 05 11

Fax: (+962 6) 556 05 14

e-mail: info@jai.jo

Web: www.jai.jo

PRESIDENT AND CEO: Muayad al Samaracee

MARKETING DIRECTOR: Tamara Marsh

MANUFACTURING PLANT

Queen Alia International Airport, Private Free Zone, Amman

Founded 2001 to provide aviation-related services to Middle East, Africa and Asia. By late 2003, had formed alliances with Remos and Germany, Lilienthal of Ukraine and SportCopter and Zenair of USA for local assembly of various light aircraft, as detailed. Awarded Product on Certification No. 1 (J-SCH-01) by Jordanian Civil Aviation Authority on 4 December 2003, initially for assembly of CH2000, first of which flew in Jordan on 14 December 2003. Had sold 25 aircraft (types not disclosed) by end of 2003.

The 6,200 m² (66,650 sq ft) Queen Alia plant is staffed by engineers trained and certified in Canada.

Associated ventures include flight training, research & development, aerial work (pipe/power-line monitoring, agricultural spraying), support of law enforcement, aerial tourism and spare parts supply.

Aircraft offered by JAI have been given local names, as summarised:

Hawk-I CH8000: Version of Zenith Super STOL CH 801 metal, four-seat lightplane. Offered with 134 kW (180 hp) Lycoming or 169 kW (227 hp) SMA Diesel. Military version known as **Shark**. In March 2005, USD6 million contract received for six (plus training and spare parts) in spraying role for Iraq Ministry of Agriculture. Production certificate (J-SCH-02) issued 16 June 2005.

RaLi: Version of German Remos G-3 Mirage composites, two-seat ultralight.

SAMA-CH2000: Version of AMD Zenith CH2T (CH 2000 Alarus) metal two-seat lightplane and primary trainer; retains 86.5 kW (116 hp) Textron Lycoming O-235 engine. Four ordered by Royal Jordanian Air Academy (RJAA) at Amman for delivery from November 2003; demonstrator, US-built CH2000 N604AM, displayed at Dubai Air Show, 7 to 12 December 2003. First Jordanian-built, JY-MA8, flew 14 December 2003. Deliveries to RJAA began 24 January 2004. Options include Sandel 3308 EFIS for instrument training.

SAMA CH2000 MTSA: Surveillance version (launched as CH2000-S330) with Harris



JAI-built SAMA CH2000s of Royal Jordanian Air Academy

1151734

secure comms (30 to 50 mHz and 1.5 to 60 mHz) and ventral, gyro-stabilised Ultra 8500FW IR and TV imaging turret, having 450 mm telephoto and 3.5 km (2.2 mile) range from 600 m (2,000 ft); IFR capable; fuel capacity increased to 129 litres (34.0 US gallons; 28.3 Imp gallons) for up to 5 h 30 min endurance and range of 470 n miles (870 km; 540 miles) at 60-70 kt (111-130 km/h; 69-81 mph).

In October 2004, 16 SAMA CH2000-S330s ordered for Iraqi Air Force in USD12 million contract placed by US Army and including training (pilots and engineers) and long-term support. Deliveries began February 2005, following issue of Supplementary Type Certificate for turret installation on 25 November 2004.

SAMA CH2000-A: Uprated version with 104 kW (140 hp) Lycoming and multifunction displays.

SAMA CH2000-B: Available from 2006 with 99 kW (132.8 hp) Thielert Centurion 1.7 Diesel engine.

SAMA CH2000-C: Available from 2007; enlarged wing and rudder; Diesel power under consideration.

Hajanah: El Gavilan EL-1 Gavilan 358 eight-seat utility transport (261 kW; 350 hp Textron Lycoming TIO-540) last produced in Colombia. Available in EL-1, EL-1C, EL-1D and EL-1T versions. Production rights acquired via Zenair in 2005.

Shibel: Viper ViperJet two-seat personal jet; available in MT3 and MMP3 versions. The following no longer appear to be receiving promotion:

Barq S Copter: Single-seat autogyro. Version of Sport Copter Lightning. US manufacture by Sport Copter Inc (www.sportcopter.com). Rotax 503 UL engine; 37.0 kW; 49.6 hp. Weight 114 kg (252 lb) empty; 272 lb (600 lb) max T-O; max level speed 55 kt (101 km/h; 63 mph); max rate of climb 305 m (1,000 ft)/min; range 90 n miles (161 km; 100 miles).

Gulf Bird X-34: Three-seat, ultralight development of Lilienthal X-32.

RumBird X-32: Tandem-seat ultralight. Version of Lilienthal X-32 Bekas.



JAI Hajanah, alias EL-1 Gavilan

0106488



Shark military version of JAI CH8000 with armoured door and belly

1151733

Gulf Bird Observer: X-32 variant with surveillance equipment as for CH2000-S330, but VFR avionics. Optional alternative of aerial mapping camera.

Sea Copter: Floatplane version of Vortex S Copter.

Vortex S Copter: Single-seat autogyro. Version of Sport Copter Vortex. Rotax 582 UL two-stroke, 48.0 kW (64.4 hp) but Subaru EA81 offered by JAI. Rotor diameter 7.62 m (25 ft 0 in); max T-O weight 345 kg (760 lb); max level speed 87 kt (161 km/h; 100 mph); max rate

of climb 365 m (1,200 ft)/min; range 147 n miles (273 km; 170 miles). Optional enclosed cockpit with, or without, doors.

Vortex 2S Copter: Two-seat autogyro. Version of Sport Copter 2, Subaru EA81 flat-four engine, 82.0 kW (110 hp) or turbocharged 119 kW (160 hp). Weight 295 kg (650 lb) empty; 589 kg (1,300 lb) max T-O; max level speed 113 kt (209 km/h; 130 mph); max rate of climb 265 m (1,200 ft)/min; range 269 n miles (498 km; 310 miles).

SEABIRD JORDAN

SEABIRD AVIATION JORDAN LLC

PO Box 341708, Amman 11134

Tel: (+962 6) 488 91 99

Fax: (+962 6) 488 96 99

e-mail: info@seabirdaviationjordan.com

Web: www.seabirdaviationjordan.com

CHAIRMAN: Alec Mackenzie

CEO: Farhad Abed

COMMERCIAL DIRECTOR: Gilles Latour

DIRECTOR OF OPERATIONS: Tareq Barakat

COMMERCIAL OPERATIONS MANAGER: Mohammad Jalal

Joint venture with King Abdullah II Design and Development Bureau (KADDB), known as Seabird Aviation Jordan (SAJ) and 51 per cent Australian-owned, formed in 2003 to assemble Seeker lightplane. KADDB has acquired intellectual property and world manufacturing and sales rights, plus 100 per cent of equity. Initial operations at Marka Airport are due to have been transferred to Queen Alia IAP in 2007. First deliveries – albeit from Australian production – in 2004. Production capability to reach two per month by first quarter of 2007. Dabin Group of Iraq bought a “significant portion” of KADDB’s equity, releasing funds to accelerate SAJ’s production build-up.

Also in 2004, Seabird Jordan acquired Middle East assembly and support rights for Jabiru J400 four-seat ultralight/lightplane, initially building a J430 demonstrator. J160 version is also marketed, both under local name of **Yamamah** (Bird of Peace) Y160 and Y430.

Announced in 2005, local assembly and marketing agreement for Gippsland GA200 agricultural sprayer and at Dubai Air Show in November 2005 announced VN 1100 version of EH-1100 EHoenix light helicopter as currently promoted in US. By mid-2006, both had been removed from SAJ’s portfolio.

SEABIRD JORDAN SB7L-360 SEEKER

TYPE: Multisensor surveillance lightplane.

PROGRAMME: Design (by Bill Whitney) began January 1985; Seabird Aviation Australia began construction January 1988; first flight of first (SB5N) prototype (VH-SB1, c/n 001, with Norton rotary engine) 1 October 1989, and of SB5E second prototype (VH-SB1, c/n 003, with Emdair engine) 11 January 1991 (c/n 002 was structural test airframe); fourth aircraft (c/n 004, VH ZIG) was SB7L Seeker prototype, making first flight 6 June 1991; Seabird SB7L-235 certified by CASA 12 March 1993; definitive SB7L-360A (VH-OPT; first flight early 1993) has Textron Lycoming O-360 engine for higher performance and received Australian CAA type approval on 24 January 1994 and certification to FAR Pt 23 on 24 March 1999. Operational testing of Seeker included use as an airborne surveillance platform in October 1995 trials by the Australian Army. Components for an initial production batch of five aircraft completed by December 1997. Project then frozen and franchised producer sought, apparently being achieved in July 2000, on signature of agreement with Evkektor Aerotechnik. Negotiations were said to be continuing up to early 2003, at which time commercial discussions opened with KADDB in Jordan.

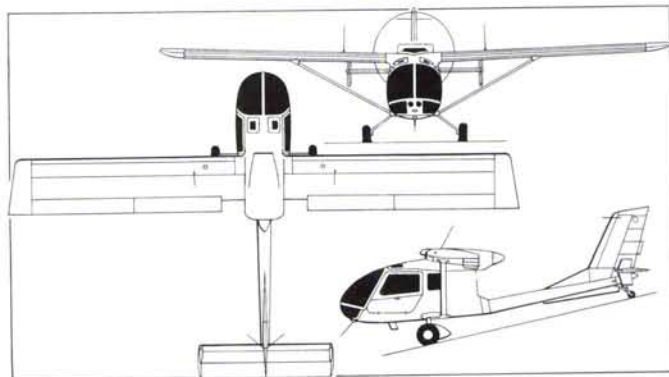
Fifth aircraft (VH-SBO c/n 006) registered June 2003, being first to conform to production certification. On 17 August 2003, KADDB and Seabird Australia revealed joint venture (Seabird Jordan) for assembly of Seekers at Marka. First aircraft, JY-SEE (the former VH ZIG), shipped from Australia in September 2003 and flew in Jordan on 2 October. Second arrival in Jordan, March 2004, was former VH-OPT, joined in July 2004 by VH-SBO. After integration of communications equipment, avionics and surveillance systems by Seabird Jordan, two last mentioned supplied to Iraqi Air Force. First locally built aircraft were due in mid-2006, with manufacture transferring to new plant at Queen Alia International Airport in late 2006.

Australian certification revised on 18 January 2006 to incorporate MTOW increase from 897 kg (1,977 lb) to 925 kg (2,039 lb) and additional fuel capacity, effective from seventh aircraft, previous having 160 litres (42.3 US gallons; 35.2 Imp gallons) gross. In 2006, further improvements under development for Royal Jordanian Air Force Seekers including Dyneema ballistic protection system for fuselage at weight penalty of 5 kg (11 lb);



FLIR turret fitted to Seabird Seeker

1158850



Seabird SB7L Seeker (Mike Keep)

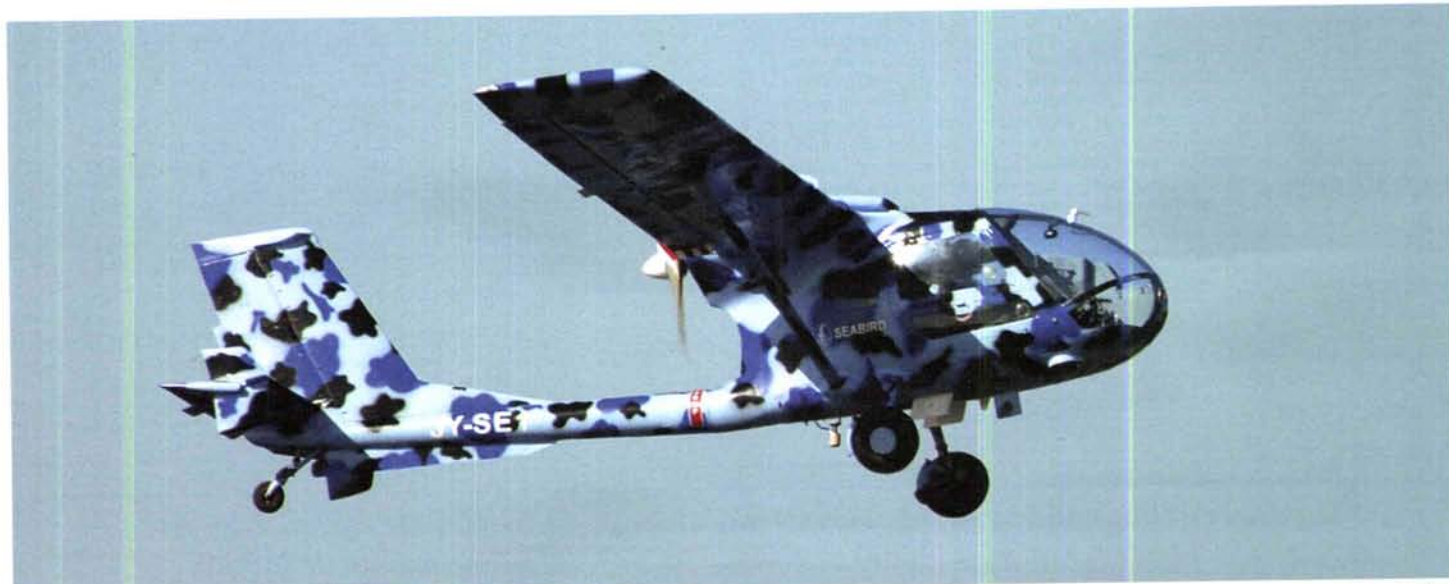
0093657

improved cooling system; and replacement of BB177 propeller by Hoffmann unit offering 10 per cent more thrust, increasing climb rate by 91 m (300 ft) per minute and endurance at cruising power from 4 h 30 min to 5 h 40 min. Later improvements intended to include 134 kW (180 hp) Vantage fuel-injected engine and three-blade, constant speed propeller.

CURRENT VERSIONS: **SB7L:** As described.

Four-seat: Reportedly under development by 2006.

CUSTOMERS: Initial Jordanian order placed mid-2003 for two (2004 and 2005 deliveries) for Aqaba Special Economic Zone Authority in maritime surveillance role, Royal Jordanian Air Academy ordered two on 8 October 2003 and holds option on further pair for 2005 delivery. On 10 June 2004, Iraqi Air Force purchased two Seekers from KADDB; requirement existed



Jordanian-assembled Seeker delivered to South Africa (Jane's/Patrick Allen)

1196698



Current Seabird Seeker with Garmin GNS 530 screen 1158243

for fleet of 16 in surveillance role but these orders were assigned, instead, to rival JAI and its SAMA 2000. Initial two aircraft, registered YI-101 and YI-102, both from previous Australian production, handed over 29 July 2004 and delivered from Jordan to Basrah, Iraq, by USAF C-130 Hercules on 3 August 2004, as equipment of 1 Air Reconnaissance Squadron.

In October 2004, Paramount Group of South Africa ordered five Seekers, for immediate delivery and placed option on further five to be supplied in 2006; two of initial order for operation by Ghana Air Force, while another to be South African-based demonstrator. Two ordered December 2005 by Jordan Aviation on behalf of two countries "with close ties to Jordan". Deliveries of new-built Jordanian aircraft began early 2006 with JY-SE1 to South Africa. Demonstrator (N94399) shipped to US in July 2006 for promotion by Seabird Aviation America at Albuquerque.

Jordanian Air Force ordered six Seekers in March 2006.

SEABIRD SEEKER PRODUCTION

c/n	Version	Registration
89001	SB5	VH-SBI, Withdrawn, Cancelled 6 Aug 04
002	SB5	static test airframe
90003	SB5	VH-SBU, Withdrawn, Cancelled 6 Aug 04
91004	SB7L	VH-ZIG, JY-SEE
92005	SB7L	VH-OPT, JY-SEA, YI-101
02006	SB7L	VH-SBO, YI-102
SAJ06001	SB7L-360B	JY-SE1
SAJ06002	SB7L-360B	
07009	SB7L-360A	N94399

Notes: 007 to 011 in stock as components since 1996

COSTS: USD269,000 in basic configuration (2006).

DESIGN FEATURES: Braced high-wing monoplane with pod and boom fuselage, extensively glazed cabin and slightly sweptback vertical tail. Ventral and auxiliary fins added early 1993. Primary applications are observation/reconnaissance, offering helicopter-like view from cockpit and good low-speed handling and loiter capabilities; training and agricultural use also foreseen.

Wing section NACA 63₂-215 (modified); wedge tips; twist 3°, incidence 4° at root, 1° at tip; dihedral 2° 30' from roots.

FLYING CONTROLS: Conventional and manual. Rod-actuated slotted ailerons, one-piece horn-balanced elevator (with trim tab) and horn-balanced rudder; three-position (0, 20, 40°) slotted flaps on wing trailing-edge; fixed incidence tailplane. Inboard stall strips; vortex generators on wing upper surface near leading-edge and lower surface forward of ailerons; elevator bias trim.

STRUCTURE: Front fuselage mainly of 4130 chromoly steel tube with Kevlar non-load-bearing skin; aluminium alloy tubular tailboom; wings and tail unit conventional aluminium alloy stressed skin structures, former with single bracing strut and jury strut each side.

LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted spring steel cantilever mainwheel legs with cutaway wheel fairings. Cleveland 8.00-6 mainwheels and fairings on cantilever

spring steel legs; fully castoring Scott 8 in tailwheel with oil/nitrogen oleo strut and 210x65 McCreary tyre. Mainwheel tyre pressure 1.38 bar (20 lb/sq in); Cleveland disc brakes. Float gear to be developed.

POWER PLANT: One Textron Lycoming O-360-B2C flat-four engine, derated to 125 kW (168 hp) from 134 kW (180 hp) with lower compression ratio of 7.5:1 for Mogas fuel. Low propeller tip speed for minimal noise; Bishton BB177 two-blade fixed-pitch wood/composites pusher propeller. Fuel in two 92 litre (24.3 US gallon; 20.2 Imp gallon) integral wing tanks, each with overwing gravity filling point. Total 172 litres (45.4 US gallons; 37.8 Imp gallons) usable. Provision for auxiliary fuel tanks on underwing hardpoints. Oil capacity 7.5 litres (2.0 US gallons; 1.6 Imp gallons).

ACCOMMODATION: Side-by-side seats, adjustable fore and aft, for pilot and co-pilot or observer/passenger in extensively glazed cabin. Dual controls and four-point inertia reel seatbelts standard. Split (upward/downward-hinged) door each side, both removable. Ram air cabin ventilation. Space for 43 kg (95 lb) of baggage aft of seats.

SYSTEMS: 28 V electrical system, with 70 A alternator and Gill 246 battery, for engine start, instruments and lighting.

AVIONICS: *Comms:* Garmin GMA 340 audio panel, GL 40 VHF, GNS 430/530 com/nav. GTX 327 transponder.

Flight: Garmin GI 106 VOR/GS/LOC.

Mission: Iraqi aircraft have FLIR Systems 8500 surveillance system. Jordanian Air Force aircraft to have L-3 Wescam MX-15 and NVG capability.

Self-defence: Lacroix flare dispensing system under development in 2006, one eight-round unit under each wing.

EQUIPMENT: Hardpoint for 60 kg (132 lb) of external stores beneath each wing. Quick-change photo/survey modules, stretcher or 100 litre (26.4 US gallon; 22.0 Imp gallon) spraytank optional in place of right-hand seat.

DIMENSIONS, EXTERNAL:

Wing span	11.07 m (36 ft 4 in)
Wing chord, constant	1.22 m (4 ft 0 in)
Wing aspect ratio	9.4
Length overall	7.01 m (23 ft 0 in)
Fuselage max width	1.14 m (3 ft 9 in)
Height: to fin tip	2.03 m (6 ft 8 in)
overall, propeller vertical	2.49 m (8 ft 2 in)
Tailplane span	2.90 m (9 ft 6 in)
Wheel track	2.03 m (6 ft 8 in)
Wheelbase	4.75 m (15 ft 7 in)
Propeller diameter	1.77 m (5 ft 9¾ in)
Cabin doors (two, each): Height	0.83 m (2 ft 8¾ in)
Width	0.98 m (3 ft 2½ in)
Height to sill	0.98 m (3 ft 2½ in)

DIMENSIONS, INTERNAL:

Cabin, incl baggage space:

Length	2.21 m (7 ft 3 in)
Max width	1.12 m (3 ft 8 in)
Max height	1.09 m (3 ft 7 in)
Baggage compartment volume	0.75 m³ (26.5 cu ft)

AREAS:

Wings, gross	13.06 m² (140.6 sq ft)
--------------	------------------------

WEIGHTS AND LOADINGS:

Basic weight empty	604 kg (1,332 lb)
Max fuel weight	132 kg (292 lb)
Baggage capacity	45 kg (99 lb)
Max T-O and landing weight	925 kg (2,039 lb)
Max wing loading	70.8 kg/m² (14.50 lb/sq ft)
Max power loading	7.39 kg/kW (12.14 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	134 kt (248 km/h; 154 mph) CAS
Cruising speed at 75% power	108 kt (200 km/h; 124 mph)
Minimum patrol speed	65 kt (120 km/h; 75 mph) CAS
Stalling speed, flaps down	53 kt (99 km/h; 61 mph) IAS
Rate of climb: at S/L	330 m (1,085 ft)/min
at FL60	190 m (650 ft)/min
Service ceiling	4,648 m (15,250 ft)
T-O run	265 m (870 ft)
Landing run	199 m (655 ft)
Range with reserves:	
at min patrol speed	423 n miles (783 km; 487 miles)
at 65% power	570 n miles (1,056 km; 656 miles)
Endurance, with reserves: at min patrol speed	6 h 30 min
at 65% power	5 h 42 min
g limits	+3.8/-1.52

Kazakhstan

YAK ALACON

YAK ALACON JSC
 prospekt Abaya 153, Ofis 15, Almaty
 Tel: (+7 3272) 50 93 96
 Fax: (+7 3272) 95 98 88
 e-mail: info@yakalacon.com
 Web: www.yakalacon.com
 PRESIDENT: Alexandr I Toporov
 VICE-PRESIDENT: Rustam N Abdulin

This company was formed in conjunction with the Yakovlev design bureau of Russia to complete Russian certification of, market and manufacture the Yak-58, although it also markets the Yak-18T, 40, 42D, 52 and 54. US marketing office at Decatur, Georgia, USA, the intention being to achieve FAA certification and assemble some aircraft in that country. Yak-58 production had previously been intended by Tbiliviamsheni (formerly TAM) at Tbilisi, Georgia, CIS, but the project was suspended in 1997. By early 2006, the company was still seeking investors to launch production of the Yak-58, implying no immediate prospect of new deliveries.

Korea, South

KAI

KOREA AEROSPACE INDUSTRIES LTD

HEAD OFFICE (SACHEON BUSINESS SITE 1): 802 Yuchon-ri, Sanam-myun, Sacheon, Gyeongnam-do 664710

Tel: (+82 55) 851 12 46

Fax: (+82 55) 851 11 90

Web: www.koreaero.com

PRESIDENT AND CEO: Chung, Hae-Joo

EXECUTIVE VICE-PRESIDENT AND GENERAL MANAGER, BUSINESS DEVELOPMENT AND MARKETING DIVISION: J J Park

VICE-PRESIDENT, MARKETING: Alex Jun

SEOUL OFFICE: 135 Seosomun-dong, Jung-gu, Seoul 100737

Tel: (+82 2) 20 01 30 00

Fax: (+82 2) 20 01 30 11

SACHEON BUSINESS SITE 2: 55 Yongdang-ri, Sacheon-eup, Sacheon, Gyeongsangnam-do 664802

Tel: (+82 55) 851 25 14

Fax: (+82 55) 854 86 38

CHANGWON BUSINESS SITE: 24-4 Seongju-dong, Changwon, Gyeongsangnam-do 641120

Tel: (+82 55) 280 68 00

Fax: (+82 55) 285 23 83

Korea Aerospace Industries was established on 1 October 1999 by consolidating the aerospace business of Daewoo Heavy Industries, Samsung Aerospace and Hyundai Space & Aircraft to create a single, unified aircraft manufacturer. In 2000, the Korean government designated KAI as the sole specialised aerospace defence industry in Korea, with exclusive and preferential rights in Korean aerospace defence programmes. KAI is headquartered in Sacheon and operates three business sites, including a Seoul office and two research facilities in the Sacheon, Changwon and Daejeon areas; total workforce was 2,700 in September 2005. Main Sacheon business site (664,000 m²; 7,147,230 sq ft) accommodates T-50 production line; manufacture of AH-64D fuselages (first delivery 14 April 2005) and F-15K wings; and will modify three of the four Boeing 737 AEW&Cs ordered for the RoKAF's EX programme under a USD1.59 billion contract announced in November 2006. 123,000 m² (1,323,960 sq ft) facility at Changwon produces KT-1 and will house P-3 upgrade programme.

KAI has successfully completed the KFP (Korean Fighter Programme) for RoKAF. It has completed RoKAF production and delivery of the indigenous KT-1 basic trainer, of which seven KT-1Bs have also been sold to the Indonesian Air Force with five more on order.

KAI is continuing its T-50 advanced trainer/lead-in fighter trainer/light combat aircraft development successfully, with the first production examples now delivered. Further, thanks to serial production contracts with RoKAF in 2003, KAI is in a position to develop a Korean state-of-the-art fighter as well as export the supersonic trainer worldwide.

KAI has signed with Bell and Mitsui for developing a new helicopter known as the Bell 429. In addition, it was major contractor for upgrading Lockheed Martin P-3B Orion maritime patrol aircraft for the Republic of Korea Navy in 2005.

KAI is laying the groundwork for a long-term growth through new programmes such as the Korean Helicopter Programme (KHP), as well as expanding commercial business by strengthening partnerships with global airframe manufacturers such as Boeing and Airbus. Replacing the aborted KMH competition, the KHP was confirmed by the RoK government in 2004 as a development programme for a utility helicopter to replace ageing types such as the UH-1H and MD 500 in both the Army and the Air Force. Provisionally designated KUH (Korean Utility Helicopter), it is to be an 8 tonne indigenous aircraft, with KAI as prime contractor, accompanied by an international partner to perform systems integration. Up to 245 KUHs may be acquired under the programme. An RFP was issued in April 2005, attracting bids from AgustaWestland, Bell and Eurocopter, from which the last-named was selected in December 2005.

KAI KT-1 WOONG-BEE

English name: Great Flight

TYPE: Basic turboprop trainer.

PROGRAMME: Started February 1988; built under KTX (Korean Trainer Experimental) programme to design by Daewoo and ADD (Agency for Defence Development); construction of first prototype began June 1991; nine prototypes (01-05 flying and 001-004 for static and fatigue test), of which 01, with 410 kW (550 shp) PT6A-25A engine, rolled out November 1991 and made first flight 12 December that year; 02, identical to 01, made first flight 5 February 1993; 03 (with PT6A-62) made first flight on 10 August 1995; named Woong-Bee in November 1995; 04, which first flew on 10 May 1996, further modified with



Model of KT-1C at Seoul Air Show in October 2005 (Jane's/Robert Karniol)

116778

nose shortened and horizontal tail surfaces remounted lower and farther aft; 03 also modified to this standard. Fifth (preproduction) prototype 05 flew for the first time on 16 March 1998; development and operational testing completed 18 September 1998 after 1,474 flying hours in 1,184 sorties. Series production began 1999; first aircraft handed over to RoKAF at Sacheon AB on 7 November 2000 for use by 217 Tactical Training Squadron. All 92 ordered had been delivered by June 2004. Development of KT-1C continuing in 2004-06.

CURRENT VERSIONS: **KT-1:** Standard RoKAF basic trainer, as described.

KT-1B: Export version for Indonesian Air Force (initially seven); some different avionics to customer's requirements and no Tacan or automatic rudder trim. Further five on order in 2005.

KT-1C: New export version, with enhanced avionics suite integrated by CMC Electronics of Canada, based on that company's 25th field of view Sparrowhawk HUD, HOTAS controls and a pair of CMC FV-4000 mission computers. 'All-glass' cockpit also features CMC up-front control panel and (in both cockpits) three 127 × 178 mm (5 × 7 in) MFDs. A cockpit demonstrator was displayed at the Seoul Air Show in late 2003. Other features include ability to carry a FLIR sensor and laser range-finder on the centreline stores station; weapon delivery system (simulated and live); fifth (underfuselage) hardpoint; a vapour-cycle ECS; and OBOGS. Active development started in November 2004; scheduled to be completed in 2008-09.

KO-1: Forward air control (Korean Observer) armed version for RoKAF. Development started in 2000 by modifying aircraft 05 to FAC configuration as XKO-1 with weapon management system, HUD, armament management LCD MFD and four underwing hardpoints; first flight in this configuration 1 November 2001. Development delayed, but contract for 20 awarded December 2003; first delivered August 2005; remainder due by 2008.

CUSTOMERS: Total of 105 production aircraft approved by Republic of Korea Air Force (RoKAF). Contract 9 August 1999 for 85 KT-1 trainers, last of which delivered by June 2004, replacing Cessna T-37s. Follow-on order for 20 KO-1s for forward air control duties.

Indonesian Air Force announced order for seven KT-1Bs on 26 February 2001, first six of which were delivered between 19 June and 26 July 2003; first aircraft (LD-0101) released to Indonesian Air Force 25 April 2003 in advance of official handover; replaced Beechcraft T-34Cs of No. 102 Squadron at Halim Perdanakusuma AB, Jakarta. Five more on order.

COSTS: Reported unit costs of USD5 million for RoKAF, USD3.995 million for Indonesian Air Force (2003).

DESIGN FEATURES: Meets requirements of FAR/JAR 23 (Aerobatic Category) and MIL-F-8785C trainer category Class IV. Able to cover entire primary and basic training syllabus and forward air control missions.

Unswept low wing with NACA 63-218 (root) and 63-212 (tip) aerofoil sections; tandem cockpits; conventional unswept vertical and horizontal tail surfaces; retractable tricycle landing gear. Four or five weapon hardpoints on KO-1 and KT-1C.

FLYING CONTROLS: Primary control surfaces actuated mechanically, with electrically operated trim tab in starboard elevator and port aileron; automatic rudder trim (not on KT-1B)



KAI KT-1 turboprop trainer in RoKAF service

0576527



KAI KO-1 forward air control turboprop

1158179

compensates for propeller-induced yaw to provide jet-like handling; rudder and One-piece elevator are horn-balanced. Airbrake under centre-fuselage and split flaps on wing trailing-edge are hydraulically operated.

LANDING GEAR: Hydraulically retractable tricycle type, with single wheel and oleo-pneumatic shock-absorber on each unit. Mainwheels retract inward; nosewheel is steerable $\pm 18^\circ$ and retracts rearward. Parker Hannifin mainwheels with 18x5.5 tyres (10 ply), pressure 9.65 bar (140 lb/sq in). Dunlop nosewheel with 5.00 5 tyre (14 ply), pressure 6.90 bar (100 lb/sq in). Parker Hannifin hydraulic mainwheel brakes.

POWER PLANT: One 708 kW (950 shp) (flat rated) Pratt & Whitney Canada PT6A-62 turboprop, driving a Hartzell HC-E4N-2/E9512CB-1 four-blade constant-speed fully feathering propeller. Single-lever combined control for engine fuel and propeller pitch.

Fuel in one 275.5 litre (72.8 US gallon; 60.6 Imp gallon) integral tank in each wing, giving total internal fuel capacity of 551 litres (146 US gallons; 121 Imp gallons). Gravity fuelling point in each wing upper surface. Provision for 189 litre (50.0 US gallon; 41.6 Imp gallon) auxiliary fuel tank on each inboard underwing station. Oil capacity 5.7 litres (1.5 US gallons; 1.25 Imp gallons). Fuel system permits up to 30 seconds of inverted flight.

ACCOMMODATION: Instructor and pupil in tandem cockpits on Martin-Baker Mk 16LF zero/zero ejection seats; rear seat elevated. One-piece canopy with MDC opens sideways to starboard.

SYSTEMS: Compressed bleed air air conditioning system for cockpit ventilation, heating, cooling and demisting; heating and cooling by wheel bootstrap air cycle system driven by engine compressor. Self-pressurised main and emergency hydraulic systems, operating pressure 207 bar (3,000 lb/sq in), flow rate 17.8 litres (4.7 US gallons; 3.9 Imp gallons)/min at 7,650 rpm. Pneumatic back-up system, also 207 bar (3,000 lb/sq in), for landing gear, wheel bay doors and flaps. Electrical power (28 V DC) available from engine-driven starter/generator and built-in battery, or from external power source. Fixed-geometry inertial separator for engine intake anti-icing. Diluter demand oxygen system provides 1,367 litres (48.2 cu ft) gaseous capacity for crew; selected and controlled individually from regulator/control panel in each cockpit.

AVIONICS (KT-1): Comms: UHF/VHF radio, IFF, interphone and communication control system; optional ELT.

Flight: AHRS and Tacan; optional VOR/ILS.

Instrumentation: EFIS with standby attitude indicator, flight control management system, electronic engine instruments and standby magnetic compass.

AVIONICS (KT-1B): Comms: Commercial instead of MIL-STD UHF/VHF; ATC transponder replaces IFF; Tacan and flight load data recorder deleted.

AVIONICS (KT-1C): Comms: VHF radios, interphone and communication control system; optional IFF and ELT.

Flight: GPS/INS, VOR/ILS and ATC; Tacan optional.

Instrumentation: HUD with UFCP; three MFDs; electronic back-up flight instruments.

AVIONICS (KO-1): Comms: Integrated UHF/VHF radios, IFF, interphone and control system; optional ELT.

Flight: GPS/INS and Tacan; optional VOR/ILS.

Instrumentation: As KT-1, plus Elop HUD and Astronautics MFDs. Options include mission computer, AVTR and NVG-compatible cockpit lighting system.

ARMAMENT (KO-1 and KT-1C): Two stores stations under each wing for two LAU-3A or LAU-131A seven-round rocket launchers or two 0.50 in machine gun pods; or two LAU-131As and two auxiliary fuel tanks. With fifth (fuselage centreline) station, options can be extended to include Mk 81 or 82 bombs, laser range-finder, FLIR or training AAM.

DIMENSIONS, EXTERNAL:

Wing span	10.59 m (34 ft 9 in)
Wing chord; at root	2.06 m (6 ft 9 in)
at tip	0.97 m (3 ft 2 in)
Wing aspect ratio	7.0
Length overall	10.26 m (33 ft 8 in)
Height overall: KT-1	3.68 m (12 ft 1 in)
KO-1	3.78 m (12 ft 5 in)
Tailplane span	4.17 m (13 ft 8 in)
Wheel track	3.54 m (11 ft 7 in)
Wheelbase	2.57 m (8 ft 5 in)
Propeller diameter	2.44 m (7 ft 11 in)
Propeller ground clearance	0.38 m (1 ft 3 in)

DIMENSIONS, INTERNAL:

Cockpits: Length (total)	3.20 m (10 ft 6 in)
Max width	0.99 m (3 ft 3 in)
Max height	1.52 m (5 ft 0 in)

AREAS:

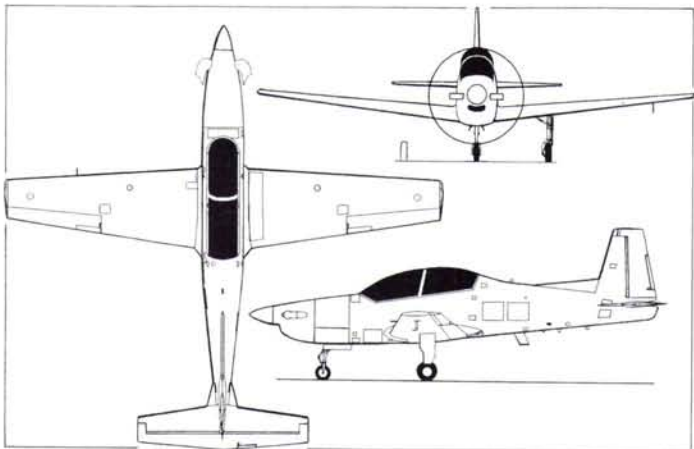
Wings, gross	16.01 m ² (172.3 sq ft)
Ailerons (total, incl tabs)	1.11 m ² (11.95 sq ft)
Trailing-edge flaps (total)	2.22 m ² (23.90 sq ft)
Fin, incl dorsal fin	1.35 m ² (14.57 sq ft)
Rudder, incl tab	0.88 m ² (9.43 sq ft)
Tailplane	2.32 m ² (25.02 sq ft)
Elevators (total, incl tab)	1.19 m ² (12.78 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	1,910 kg (4,210 lb)
Max fuel weight	408 kg (900 lb)
Max T-O and landing weight:	
Aerobatic	2,540 kg (5,600 lb)
Utility	3,205 kg (7,065 lb)
with external stores	3,311 kg (7,300 lb)
Max wing loading:	
Aerobatic	158.7 kg/m ² (32.50 lb/sq ft)
Utility	200.2 kg/m ² (41.00 lb/sq ft)
with external stores	206.8 kg/m ² (42.37 lb/sq ft)
Max power loading:	
Aerobatic	3.59 kg/kW (5.89 lb/shp)
Utility	4.53 kg/kW (7.44 lb/shp)
with external stores	4.68 kg/kW (7.68 lb/shp)

PERFORMANCE:

Never-exceed speed (VNE)	350 kt (648 km/h; 402 mph)
Max level speed at 4,570 m (15,000 ft):	
KT-1	280 kt (518 km/h; 322 mph)
KO-1 with external stores	244 kt (513 km/h; 280 mph)
Max operating speed	310 kt (574 km/h; 357 mph) IAS
Stalling speed, flaps down	71 kt (132 km/h; 82 mph) IAS
Max rate of climb at S/L: clean	1,067 m (3,500 ft)/min
Absolute ceiling: clean	11,580 m (38,000 ft)
with external stores	9,140 m (30,000 ft)



KAI KT-1 basic trainer (P&WC PT6A-62A turboprop engine) (Paul Jackson)

1158180

T-O run	244 m (800 ft)
T-O to 15 m (50 ft)	494 m (1,620 ft)
Landing from 15 m (50 ft)	727 m (2,385 ft)
Landing run	397 m (1,300 ft)
Range at 7,620 m (25,000 ft), max internal fuel and 30 min reserves	720 n miles (1,333 km; 828 miles)
Ferry range at 6,100 m (20,000 ft) max internal and external fuel, 30 min reserves	900 n miles (1,666 km; 1,035 miles)
Endurance at 6,100 m (20,000 ft), max internal fuel and 30 min reserves	up to 4 h
g limits: Aerobatic, clean	+7/-3.5
with two LAU-131s and two drop-tanks	+4.5/-2.3

KAI T-50 GOLDEN EAGLE

RoKAF designation (LIFT version): A-50

TYPE: Advanced jet trainer/light attack jet.

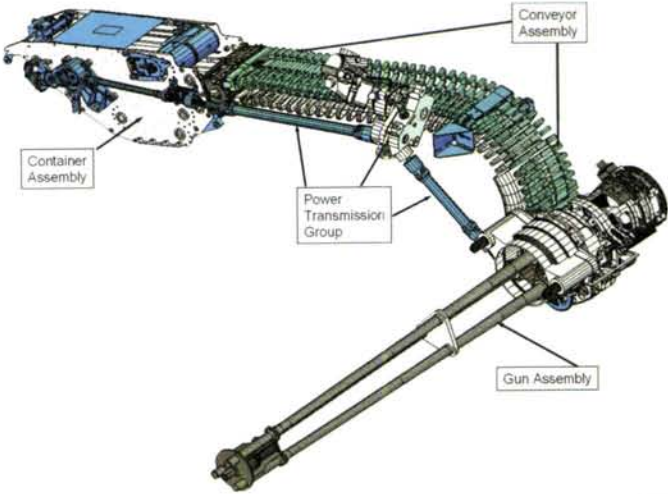
PROGRAMME:

DEVELOPMENT MILESTONES

T-50	
Launched	92
Go-ahead	3 Jul 97
Design frozen	Nov 99
Rolled out	31 Oct 01
First flight	20 Aug 02
First order	19 Dec 03
First delivery	4 Jan 06
Subsequent versions	
A-50	
First flight	29 Aug 03

Begun by Samsung Aerospace (SSA) in 1992 under designation KTX-2 (Korean Trainer, Experimental); initial design assistance by Lockheed Martin as offset in F-16 Korean Fighter Programme; early design featured shoulder-mounted wings and twin tail unit; revised later to present configuration; basic configuration established mid-1995; full-scale development originally planned to begin in 1997, subject to finding risk-sharing partner; government go-ahead given on 3 July 1997; Samsung/Lockheed Martin agreement September 1997 to continue joint development until 2005; Lockheed Martin Aeronautics at Fort Worth responsible for wings, flight control system and avionics; development phase funded 70 per cent by South Korean government, 17 per cent by Samsung/KAI and 13 per cent by Lockheed Martin.

FSD contract, signed 24 October 1997, called for two static/fatigue test airframes and four flying prototypes (two T-50 and two A-50). Work split 55 per cent in USA, 44 per cent



A-50 gun detail (General Dynamics)

1039306

in South Korea and 1 per cent elsewhere. Preliminary design review (PDR) completed 12 to 16 July 1999; wind tunnel testing completed (4,800 hours) and aerodynamic design frozen November 1999. Critical design review (CDR) passed in August 2000. KTX-2 redesignated T-50 and A-50 in early 2000. T-50 International (TFI) established September 2000 (following July MoU) by KAI and LM Aero to market aircraft outside South Korea.

First prototype entered final assembly January 2001 and rolled out 31 October 2001; first flights 20 August (001) and 8 November 2002 (002). Static testing began 2 January 2002 and completed in September 2003; fatigue tests began 22 July 2002 and completed first 'lifetime' of 8,334 hours in April 2003; second lifetime (begun August 2003) completed in June 2004. First supersonic flight (M1.05 at 12,200 m; 40,000 ft) 18 February 2003 on 60th sortie; 100th test flight 28 April 2003, on which date M1.2 achieved.

Developmental flight testing (105 flights) and initial integrated logistics assessment completed by first two prototypes by mid-2003; RoKAF initial operational assessment with these two aircraft completed in 26 sorties between 28 July and 14 August 2003. Follow-on operational assessment (approximately 64 flights) to continue until 2005. Third and fourth (lead-in fighter trainer) prototypes first flown on 29 August and 4 September 2003; ground-firing tests of gun started late October 2003; flight test of APG-67 radar began December 2003 (programme of approx 80 flights, ending in mid-2004). Other tasks during 2004 included engine air starts (begun March); high and maximum AoA (June/July); stores carriage (March) and weapon release (October); maximum speed (675 kt CAS) and Mach number (10 December); maximum g loading (27-29 December); icing and other climatic trials; and continued avionics testing. By end 2003, prototypes had collectively flown 235 hours in 241 sorties; 300-hour landmark passed by February 2004. Aerial gun-firing tests took place between 26 October and 6 January 2005. By mid-March 2005 the flight test programme had involved more than 800 sorties and was 70 per cent complete, while 1,000th sortie flown 10 May 2005. Main flight test programme (1,146 sorties) completed September 2005, but further tests being flown to expand flight envelope and explore additional weapon capability.

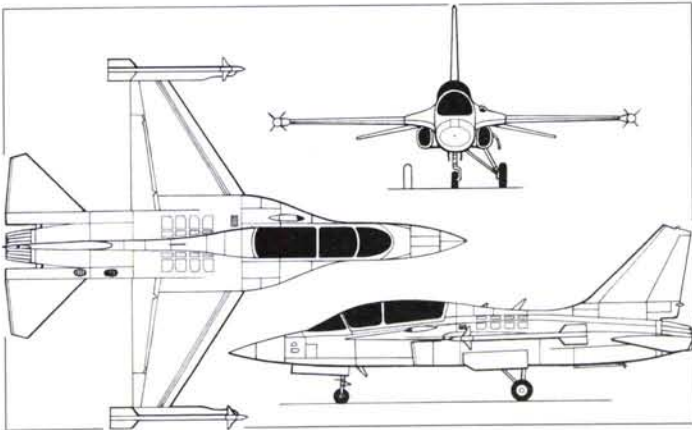
Order for first 25 production T-50s placed 19 December 2003; first of these entered final assembly 17 December 2004; rolled out (05-001) 30 August 2005; first flight 28 September 2005. Deliveries to RoKAF began 4 January 2006 with handover of first two production aircraft to RoKAF No. 52 Squadron.

Preliminary studies completed for possible 'F-50' fighter derivative, to enter development stage in about 2008 and targeted as Northrop F-5 replacement.

CURRENT VERSIONS: **T-50:** Advanced trainer; no internal gun or radar.

T-50 LIFT: Lead-in fighter trainer and light combat version with radar, weapon delivery software and internal gun. RoKAF designation **A-50**.

T-50U: Variant of T-50 LIFT proposed to United Arab Emirates in late 2003. Cockpits modified to include third, larger, MFD for commonality with UAE Air Force F-16s; HUD symbology similar to UAEAF Mirage 2000-9s; Thales TBA-6030 datalink; Terma EW suite controller; and customised mission simulation modes.



KAI T-50/A-50 Golden Eagle (James Goulding)

0589209



First production KAI T-50 Golden Eagle

1158181

CUSTOMERS: Initial RoKAF requirement for 94 (50 T-50s and 44 A-50s), with contracts expected in 2006 for second 25 of former and first 22 of latter, for delivery from 2008. Second 22 A-50s expected to be in A-50+ close air support (CAS) configuration, with enhanced weapon capability. Options for up to 100 more, including further A-50s. Initially to replace RoKAF T-38s and F-5Bs; aimed also at F-5 replacement market. Israel and UAE invited to test-fly T-50 during 2004. Exports (from late 2006) estimated potentially at 600 to 800.

COSTS: Development programme cost estimated at USD2,000 million (1995); but reassessed in 1996 as USD1,500 million, and only USD1,200 million by early 1997. Initial October 1997 FSD contract valued at approximately USD1,270 million. Development phase re-estimated at USD1.8 billion to USS2.1 billion in mid-2000. Unit cost USD18 million to USD20 million for T-50, USD20 million to USD22 million for A-50 (2000).

DESIGN FEATURES: Mid-mounted, variable camber wings, swept back on Leading-edges; Leading-edge root extensions (LERX); all-moving tailplane; sweptback fin Leading-edge. Single turbofan engine, with twin side-mounted intakes. KAI developing fuselage and tail unit. Designed for service life of up to 10,000 hours (8,300 hours for LIFT version).

FLYING CONTROLS: Digital, triple-redundant fly-by-wire control of flaperons, Leading-edge flaps, tailplane and rudder. Parker and Moog hydraulic actuators. Leading-edge manoeuvring flaps; split airbrake at rear of fuselage, between exhaust nozzle and tailplane halves.

STRUCTURE: Conventional aluminium alloy except for GFRP nose radome, control surfaces and some fairings. Lockheed Martin, avionics integration and wings for prototypes; KAI, fuselage, tail unit, production wings and final assembly at Sacheon. No periodic depot maintenance required.

LANDING GEAR: Messier-Dowty WIA hydraulically retractable tricycle type, with single wheel and oleo-pneumatic shock-absorber on each unit. Mainwheels retract into engine intake trunks, steerable nosewheel forward. Runway emergency arrester hook.

POWER PLANT: One General Electric F404-GE-102 turbofan (78.7 kN; 17,700 lb st with afterburning), equipped with FADEC. Seven internal fuel tanks (five in fuselage plus one in each wing); combined capacity 2,707 litres (715 US gallons; 595 Imp gallons). Provision for up to three 568 litre (150 US gallon; 125 Imp gallon) drop fuel tanks on centreline and/or inboard underwing stations.

ACCOMMODATION: Crew of two in tandem; stepped cockpits; Martin-Baker zero/zero ejection seats. Rear-hinged, upward-opening single canopy; one-piece wraparound windscreen.

SYSTEMS: Dual-redundant, independent hydraulic systems (A and B), each at 214 bar (3,100 lb/sq in) pressure and with flow rate of 187 litres (49.4 US gallons; 41.1 Imp gallons)/min; System A has 207 bar (3,000 lb/sq in) emergency back-up system with 100 litres (26.4 US gallons; 22.0 Imp gallons)/min flow rate. Triple-redundant electrical system (30 to 40 kVA primary, 7 kVA for emergencies) powered by three 28 V, 100 A DC converters and one 500 W battery converter. Electrical emergency power system (EEPS) operates System A emergency back-up and 1 kVA emergency generator throughout flight envelope. Hamilton Sundstrand APU provides self-contained engine starting capability on ground and up to 6,100 m (20,000 ft). Digitally controlled Hamilton Sundstrand environmental control system for avionics cooling, capacity 5.6 kW, Northrop Grumman OBOGS self-generating oxygen life support system.

AVIONICS: *Comms:* Raytheon ARC-232 UHF/VHF radio; BAE Systems APX-118 IFF. *Radar:* Lockheed Martin AN/APG-67(V)4 in A-50.

Flight: Digital fly-by-wire flight controls with HOTAS; Rockwell Collins VIR-130A VOR/LIS; nav/attack system for fighter lead-in training; Honeywell H-764G embedded GPS ring laser gyro INS; Tacan; HG-9550 radar altimeter.

Instrumentation: BAE Systems wide-angle HUD; two 127 × 127 mm (5 × 5 in) colour MFDs; Honeywell instrumentation displays (eight 76 mm; 3 in displays, including HSI, attitude indicator, electronic altimeter and Mach speed indicator).

Self-defence: A-50 provision for inert gas generation system, chaff/flare dispenser and RWR.

ARMAMENT: A-50 has internal General Dynamics 20 mm three-barrel Gatling-type cannon (modified M61A2) with 205 rounds (port LERX); max firing rate 3,000 rds/min. Both versions have seven external stations (one on centreline, two under each wing and AAM rail at each wingtip) for AAMs, ASMs, rocket pods, bombs, munition dispensers, practice bombs or equipment, and training targets. Includes AIM-9 Sidewinder and TGM-65 Maverick training missiles, CBU-58 and Mk 20 cluster munition, ACMI (Air Combat Manoeuvring Instrumentation) pod, BDU-33 practice bombs and SUU-200 dispenser equipment, AGTS and TIX-3 training targets and Mk 82/83/84 series 500/1,000/2,000 lb bombs.

DIMENSIONS, EXTERNAL:	
Wing span: incl wingtip launcher	9.45 m (31 ft 0 in)
excl wingtip launcher	9.11 m (29 ft 10¾ in)
Length overall	13.14 m (43 ft 1¼ in)
Height overall	4.94 m (16 ft 2½ in)

WEIGHTS AND LOADINGS:	
Weight empty	6,441 kg (14,200 lb)
Max internal fuel weight	2,220 kg (4,895 lb)
Max external stores	4,309 kg (9,500 lb)
Max T-O weight: clean	9,339 kg (20,589 lb)
with external stores	13,471 kg (29,700 lb)
Max power loading: clean	119 kg/kN (1.16 lb/lb st)
with external stores	171 kg/kN (1.68 lb/lb st)

PERFORMANCE (design):	
Max operating Mach No: design	1.5
tested	1.3
Max operating speed	815 kt (1,509 km/h; 937 mph)
Stalling speed	105 kt (195 km/h; 121 mph)
Max rate of climb at S/L	12,070 m (39,600 ft)/min
Absolute ceiling	16,760 m (55,000 ft)
Service ceiling	14,935 m (49,000 ft)
Max rate of roll	200°/s
T-O run	345 m (1,130 ft)
Landing run	707 m (2,320 ft)
Max range	1,400 n miles (2,592 km; 1,611 miles)
Sustained turn load factor at 4,570 m (15,000 ft)	6.5 g
g limits	+8/-3

KAI (BELL) 429

TYPE: Light utility helicopter.
PROGRAMME: KAI/Bell MoU of 4 December 2003 provides for co-development of Bell 429 IFR variant with roomier cabin and improved cold-climate performance; confirmed 19 June

2004 by agreement to contribute engineering and detail design input, and cabin/fuselage manufacture, to Canadian production line for Bell 429, for which KAI to have sales rights in South Korea and China. Co-development contract between Bell, KAI and Mitsui Bussan Aerospace (Japan) signed 6 February 2005 at Heli-Expo exhibition in Anaheim, California. Nose and fuselage for 429 prototype produced by KAI, and USD150 million agreement signed 20 February 2006 under which KAI will build airframes for all production aircraft over the next 10 years. KAI also granted rights to assemble aircraft in Korea for customers in Korea and China.

KAI KUH

TYPE: Light utility helicopter.

PROGRAMME: Former KMH (Korean Multirole Helicopter) programme cancelled on cost grounds 2004 and replaced by less ambitious KHP (Korean Helicopter Programme) for purely utility version, provisionally known as KUH (Korean Utility Helicopter); attack element of former KMH to be addresses separately later. Up to 245 KUHs may be acquired.

KAI to be prime contractor for KUH, with additional domestic contributions from KARI and Agency for Defence Development (ADD); KAI to develop 38 component items and purchase 14; respective quantities are 18 and five for KARI, 15 and 12 for ADD. Helicopter to be essentially of indigenous design, but co-developed with international partner as systems integrator. RFP issued April 2005, resulting in bids from AgustaWestland, Bell and Eurocopter, from whom last-named selected in December 2005.

Reports suggest construction of six prototypes, with some USD1.3 billion allocated for initial development phase, beginning in 2006 and aimed for a maiden flight in late 2009 and completion in 2011. Workshare in six-year development phase to be 70 per cent to Korean participants, 30 per cent to Eurocopter. In following 10-year production phase, Korean partners 60 per cent, Eurocopter 20 per cent, others 20 per cent, with overall investment estimated at USD6 to 8 billion.

STRUCTURE: Crashworthy airframe, based on that of Eurocopter Cougar, KAI responsible for fuselage, main and tail rotor gearboxes, rotor brake, instrument panel, flight control computer and hydraulic system. Main and tail rotors, rotor hubs and controls, FADEC, APU and landing gear by KARI. Eurocopter to provide transmission and autopilot subsystems, plus general technical assistance. Overall systems integration by KAI.

POWER PLANT: Two 1,193 kW (1,600 shp) class General Electric T700 turboshafts, with FADEC.

ACCOMMODATION: Two-crew 'glass cockpit'; two other crew members and up to nine armed troops.

AVIONICS: Main avionics (four-axis AFCS, mission computer, MFDs, radar, missile and laser warning receivers, navigational FLIR, radio and radar altimeter) by ADD. Bought-in items to include standby analogue instruments (KAI); and radios, data modem, helmet-mounted display system and chaff/flare dispensers (ADD). Prospective candidates for other items include Elbit Systems (EW management computer) and Thales (IR sensor, central data unit, air data system and cockpit displays).

ARMAMENT: Two 7.62 mm pintle-mounted machine guns.

DIMENSIONS, EXTERNAL (approx):	
Main rotor diameter	15.78 m (51 ft 9¼ in)
Tail rotor diameter	3.13 m (10 ft 3¼ in)
Fuselage: Length	15.24 m (50 ft 0 in)
Max width overlanding gear	2.95 m (9 8¼ in)
Max height to rotor head	4.26 m (13 ft 11¾ in)

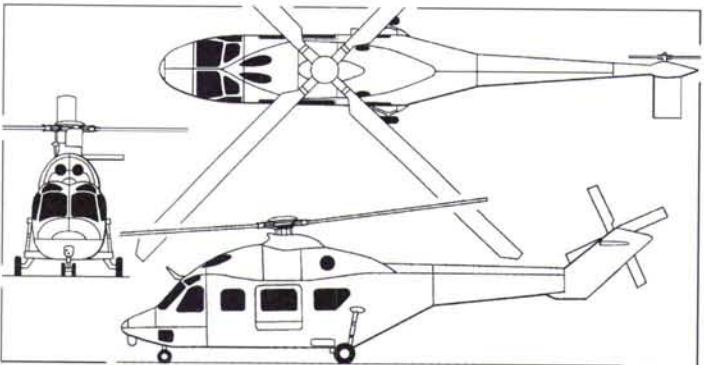
WEIGHTS AND LOADINGS (approx):	
Typical mission weight	7,030-7,484 kg (15,500-16,500 lb)
Max T-O weight	8,618 kg (19,000 lb)
Max disc loading	44.07 kg/m ² (9.03 lb/sq ft)

PERFORMANCE (design):	
Max cruising speed	more than 140 kt (259 km/h; 161 mph)
Endurance	more than 2 h



Model of KUH shown at Asian Aerospace, Singapore, February 2006 (Paul Jackson)

1158275



Provisional drawing of KAI (KHP) KUH (Paul Jackson)

1158502

KAL

KOREAN AIR LINES CO LTD
(AEROSPACE DIVISION)

41-3 Seosomun-dong, Chung-gu, Seoul 100110

Tel: (+82 2) 26 56 39 51

Fax: (+82 2) 26 56 39 17

e-mail: bep@koreanair.co.kr

Web: www.kal-ASD.co.kr

KAL CHAIRMAN AND CEO: Yang-Ho Cho

KAL PRESIDENT AND COO: Jong-Hee Lee

KAL-ASD PRESIDENT: Sang-Mook Suh

KAL-ASD MANAGING VICE-PRESIDENT, MARKETING AND PLANNING: Se-Han Kim

KAL-ASD GENERAL MANAGER, SALES AND MARKETING: In-Hwa Kim

MANUFACTURING:

103 Daejeo 2-dong, Gang Seo-gu, B

Tel: (+82 51) 970 56 20

Fax: (+82 51) 970 50 62

MANAGING VICE-PRESIDENT MILITARY AIRCRAFT PLANT: Jun-Chul Choi

MANAGING VICE-PRESIDENT, COMMERCIAL AEROSPACE PLANT: Kyung-Hwan Kwon

R&D (KOREA INSTITUTE OF AEROSPACE TECHNOLOGY)

461-1 Jeonmin-dong, Yuseong-gu, Daejeon 306811

Tel: (+82 42) 868 61 14

Fax: (+82 42) 868 61 28

MANAGING VICE-PRESIDENT: Si-Yoong Yoo

KAL's Aerospace Division was founded in 1976 and began by producing McDonnell Douglas MD 500MD and 500D helicopters under licence, the first aircraft manufacturing venture accomplished in South Korea. It soon achieved a high level of national defence capability with similar programmes which, since the 1980s, have included military aircraft such as the Sikorsky UH-60P (parts manufacture, component testing, final assembly and subsequent upgrade); Northrop F-5E/F fighter; and GD/Lockheed Martin F-16C/D (main wings and rear fuselages, as a primary contractor for the Korean Fighter Programme); and development of the MD 520K helicopter. KAL-ASD also plays an active role in modifying and maintaining various other military aircraft, supplying wings, fuselage and empennage components to a number of worldwide major manufacturers, currently including centre and rear fuselages for the KAI KT-1 basic trainer. KAL's R&D arm, KIAT, was expected to be involved in development of the new Korean Helicopter Programme (KHP), which has replaced the former Korean Multirole Helicopter (KMH).

With more than 20 years' experience of designing, manufacturing and testing structural and non-structural components, KAL-ASD has also participated in worldwide commercial aircraft development programmes, becoming a major supplier to Boeing (717, 737NG, 747, 777), Airbus (A330/340) and Embraer (170/190). It was selected in October 2005 to supply raked wingtips for the Boeing 787-8 Dreamliner.

Since beginning in 1978 with the F-4 Phantom, KAL has accumulated considerable experience and expertise in depot level maintenance for some 2,500 military aircraft of more than 30 different types on behalf of the Korean Ministry of National Defence and/or the US Defense Department, including the fixed-wing A-10, C-130, F-4, F-15, F-16 and P-3C, and AH-1, CH-47, CH-53, OH-58, UH-60, 500MD and Lynx helicopters. Attention is now focused on service life extension and systems improvement programmes.

KARI

KOREA AEROSPACE RESEARCH INSTITUTE

Aeronautics Programme Office, PO Box 113, 45 Eoeun-dong, Yuseong-gu, Daejeon 305333

Tel: (+82 42) 860 21 64

Fax: (+82 42) 860 20 15

e-mail: kjseong@kari.re.kr

Web: www.kari.re.kr

INFORMATION CONTACT: Kie-Jeong Seong (Principal Researcher)

DISTRIBUTOR:

Shin Young Heavy Industries Company

332-336 Nahul-ri, Samho, YoungAGun, Junnam-do

Tel: (+82 61) 462 37 00

Fax: (+82 61) 462 37 09

e-mail: sales@syhico.com

Web: www.syhico.com

The Aeronautics Programme Office of KARI is undertaking a study for a stratospheric airship and is engaged in the development of the Firefly four-seat light aircraft. The programme for the Bora, another four-seater, has been discontinued. In 2005, KARI was also developing an unmanned tiltrotor.

KARI FIREFLY

TYPE: Four-seat kitbuilt.

PROGRAMME: Developed by KARI as POC technology demonstrator. Prototype made maiden flight 21 September 2001; reassembled at Velocity facility in Florida June 2002 and registered N2059U, appearing at EAA AirVenture, Oshkosh, in following month. Acted as US demonstrator 2003. Donated to Polar flier Gus McLeod for flight to South Pole, leaving US on 29 December 2003, but abandoned at Marambro Station, Antarctica, in February 2004 because of unfavourable weather; subsequent appearances at Sun 'n' Fun and Oshkosh in 2004. Re-registered N90NS in November 2004; owner Polar Explorer Inc.

Second prototype meanwhile employed in Korea as avionics and equipment testbed. Shin Young Heavy Industries Company appointed by KARI in May 2003 to market kits in USA. Prototype of revised design, with new fuselage and retractable landing gear, scheduled to fly in 2005, but not reported by mid-2006.

DESIGN FEATURES: Modern, high-performance, custom-built long-range aircraft of canard configuration. Fuselage and wings of Velocity XL, but wingtip fins and rudders replaced by twin sweptback vertical tail surfaces on cantilever booms extending from wings at approximately one-third span. Incorporates latest advances in aerodynamics and construction; main objectives good utilisation, economy, comfort, simplicity and flight safety.

Wings have modified Eppler 1230 aerofoil sections, extended forward in strakes at root end, with 0° dihedral, 0° 30' incidence and 2° 30' washout; 18° sweepback on outer leading-edges; 44° 42' sweepback on strake leading-edges. Non-swept foreplane of R1145MS (modified) section, thickness/chord ratio 13.7 per cent. Vertical tail surfaces have NACA 0012 section and 35° 18' leading-edge sweepback.

FLYING CONTROLS: Conventional and mechanical, except for electrical actuation of elevator trim and speed brake. All controls horn-balanced. No flaps.

STRUCTURE: Three-piece composites wing; foreplane and tail structures of styrene foam, glass fibre, carbon fibre and epoxy; fuselage covered with glass fibre inside and out.

LANDING GEAR: Tricycle type; fixed. All units cantilevered from fuselage and fitted with wheel fairings. Toe brakes. Retractable gear version under development.

POWER PLANT: One 186 kW (250 hp) Textron Lycoming IO-540-C4B5 flat six, driving an MT Propeller MTV-9-B/LD178-102 three-blade constant-speed pusher propeller. Fuel in two strake tanks and fuselage sump tank; combined capacity 272.5 litres (72.0 US gallons; 60.0 Imp gallons), of which 266 litres (70.2 US gallons; 58.5 Imp gallons) usable.



KARI Firefly flown by Gus McLeod (Paul Jackson)

1158264

ACCOMMODATION: Pilot and three passengers, in tandem pairs. Upward-opening gull-wing door each side. Cockpit layout designed to complement pilot workload, with throttle, mixture control and rpm pedestal in centre console and pitch trim control switch on each control wheel; flyable from either front seat.

SYSTEMS: 24 V DC electrical system.

AVIONICS: VFR only. First prototype has Garmin GNS 430 (VHF, VOR and GPS), GTX 327 transponder and GMA 340 marker beacon receiver.

EQUIPMENT: External power source adaptor.

DIMENSIONS, EXTERNAL:

Wing span	10.27 m (33 ft 8 1/4 in)
Foreplane span	5.06 m (16 ft 7 1/4 in)
Length overall	6.76 m (22 ft 2 in)
Height overall	2.20 m (7 ft 2 1/2 in)
Propeller diameter	1.78 m (5 ft 10 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.13 m (7 ft 0 in)
Max width	1.27 m (4 ft 2 in)
Max height	1.08 m (3 ft 6 1/2 in)

AREAS:

Wings, gross	11.61 m ² (125.0 sq ft)
Ailerons, net	0.69 m ² (7.40 sq ft)
Foreplane, net	2.10 m ² (22.60 sq ft)
Vertical tail surfaces, total	1.58 m ² (17.00 sq ft)
Rudder, net	0.49 m ² (5.30 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, standard	832 kg (1,835 lb)
Payload with max fuel	220 kg (485 lb)
Max T-O and landing weight	1,247 kg (2,750 lb)
Max wing loading	107.4 kg/m ² (22.00 lb/sq ft)
Max power loading	6.70 kg/kW (11.00 lb/hp)

PERFORMANCE:

Max level speed at S/L	180 kt (333 km/h; 207 mph)
Cruising speed at FL 75, 75% power	170 kt (315 km/h; 196 mph)
Foreplane stalling speed	64 kt (119 km/h; 74 mph)
Max rate of climb at S/L	366 m (1,200 ft)/min
Service ceiling	6,100 m (20,000 ft)
T-O to 15 m (50 ft)	381 m (1,250 ft)
Landing from 15 m (50 ft)	305 m (1,000 ft)
Range with max fuel	1,000 n miles (1,852 km; 1,115 miles)
g limits: tested	+6
design	+9/-7

For details of the latest updates to *Jane's All the World's Aircraft* online and to discover the additional information available exclusively to online subscribers please visit
jawa.janes.com

SKYGEAR

KOREAN LIGHT AIRCRAFT CORPORATION

650 Sangro-ri, Won nam-muan, Chungbuk

Tel: (+82 16) 277 26 76

Web: www.skygear.biz

PRESIDENT: Hyung Jun Lee

VICE-PRESIDENT ENGINEERING: Paul Kenneth

Founded by Mr Lee, KLAC, which trades as SkyGear, moved from its original plant in Namwon to larger premises in late 2002. Has also established composites parts manufacturing plant in Qingdao, China. SkyGear's Comet was said to be the first South Korean homebuilt to appear on the US market and it continues to be promoted by Airdale Flyer of Caldwell, Idaho. A pusher design, the Albatross, has been added to the range.

SKYGEAR COMET

TYPE: Side-by-side ultralight/kitbuilt.

PROGRAMME: Design started by Paul Kenneth in mid-1990s; made US debut at Sun 'n' Fun in 2001. Originally promoted as ready to fly aircraft in South Korea. Marketed in US by SkyGear USA of Compton, California; promoted for LSA category. US demonstrator (N5129T) registered 2006.

CURRENT VERSIONS: **Comet 21:** Baseline version. US kit marketing by Airdale Flyer.

Comet UL: Fabric-covered wings for reduced empty weight. Wing span 10.82 m (35 ft 6 in).

Comet SP: LSA (Sport Pilot) version. Aluminium wing and composites fuselage.

COSTS: Comet SP, 200-hour quick-build kit USD19,450; 'firewall back' completely assembled USD24,450; flyaway price on application (2006).

DESIGN FEATURES: Braced high-wing monoplane, similar in appearance to Cessna 152. Available ready to fly or in kit form; quoted build time 200 to 300 hours.

FLYING CONTROLS: Conventional and manual. Frise ailerons; elevator electric trim, Fowler flaps.

STRUCTURE: Prewelded 4130 chromoly steel tube fuselage inside two CFRP half-shells; pop-rievted, single-spar, all-aluminium wing with drooped tips; all-CFRP one-piece tailplane. Wings of fabric-covered composites or all aluminium, according to version.

LANDING GEAR: Tricycle type; fixed. Rubber-sprung, steerable nosewheel; fuselage-mounted cantilever sprung steel main legs. Hydraulic brakes.

POWER PLANT: **Comet 21:** One 59.7 kW (80 hp) Jabiru 2200 engine, driving two-blade propeller.

Comet UL: One 47.8 kW (64.1 hp) Rotax 582 UL. Usable fuel capacity (two tanks) 38 litres (10.0 US gallons; 8.3 Imp gallons) standard, 76 litres (20.0 US gallons; 16.6 Imp gallons) optional.

Comet SP: One 59.6 kW (79.9 hp) Rotax 912 UL. Total fuel capacity 83 litres (22.0 US gallons; 18.3 Imp gallons).

ACCOMMODATION: Pilot and passenger. Forward-opening window/door each side; one-piece Plexiglas windscreen.

AVIONICS: VFR or IFR instrumentation to customer's choice.

Data follow for **Comet SP**.

DIMENSIONS, EXTERNAL:

Wing span 9.04 m (29 ft 8 in)
Length overall 5.89 m (19 ft 4 in)
Height overall 2.13 m (7 ft 0 in)

DIMENSIONS, INTERNAL:

Cabin max width 1.12 m (3 ft 8 in)

AREAS:

Wings, gross 11.00 m² (118.4 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 258 kg (570 lb)
T-O weight: max 499 kg (1,100 lb)
normal 419 kg (925 lb)

PERFORMANCE:

Max level speed at S/L and VNE: 104 kt (193 km/h; 120 mph)
Max cruising speed at FL70 at 75% power 102 kt (188 km/h; 117 mph)
Stalling speed, flaps down, power on 32 kt (58 km/h; 36 mph)

Max rate of climb at S/L 396 m (1,300 ft)/min
T-O run 92 m (300 ft)
Landing run 61 m (200 ft)

SKYGEAR ALBATROSS

TYPE: Three-seat kitbuilt.

PROGRAMME: Being promoted in 2006.

COSTS: Kit USD19,950; assembled (minus engine) USD23,950 (2006).

DESIGN FEATURES: High-wing monoplane with V bracing struts; wings fold for transportation and storage. Pod and boom fuselage; mid-set braced tailplane. Large baggage door optional. Aircraft is not designed for aerobatics. Quoted build time 200 hours.

FLYING CONTROLS: Conventional and manual. Primary surfaces pushrod-actuated, Frise-type ailerons; three-position Fowler flaps. Photographs of aircraft show Junkers ailerons.

STRUCTURE: Fuselage is welded chromoly 4130 steel tube truss with carbon fibre reinforced glass fibre outer shell and tail surfaces. Fuselage shell and tail feathers are epoxy primer coated. Wings have aluminium spars, composites (heat-cured epoxy resins) ribs and skin; spars and ribs pre-cut to size to eliminate builder error.

LANDING GEAR: Tricycle type; fixed. Mainwheels have cantilever, self-sprung legs, 800x6 balloon tyres and hydraulic brakes; fully steerable nosewheel. Speed fairings optional.

POWER PLANT: One 48.0 kW (64.4 hp) Rotax 582 or 59.6 kW (79.9 hp) Rotax 912 UL standard; two-blade, fixed-pitch, ground-adjustable, glass fibre pusher propeller. Can also be fitted with suitable Jabiru or BMW alternatives. Fuel tank in each wing, combined capacity 106 litres (28.0 US gallons; 23.3 Imp gallons).

ACCOMMODATION: Two seats side by side, with third seat to rear. Polycarbonate transparencies. Cabin heater optional.

DIMENSIONS, EXTERNAL:

Wing span 10.97 m (36 ft 0 in)
Wing chord, constant 1.22 m (4 ft 0 in)
Wing aspect ratio 8.6
Length: overall 5.69 m (18 ft 8 in)
wings folded 7.21 m (23 ft 8 in)
Width, wings folded 2.51 m (8 ft 3 in)
Height overall 2.235 m (7 ft 5 in)
Tailplane span 3.175 m (10 ft 5 in)
Propeller diameter 1.88 m (6 ft 2 in)

DIMENSIONS, INTERNAL:

Cabin max width 1.14 m (3 ft 9 in)

AREAS:

Wings, gross 13.94 m² (150.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 249 kg (550 lb)
Max T-O weight: Rotax 582 453 kg (1,000 lb)
Rotax 912 UL 499 kg (1,100 lb)
Max wing loading: Rotax 582 32.55 kg/m² (6.67 lb/sq ft)
Rotax 912 UL 35.80 kg/m² (7.33 lb/sq ft)
Max power loading: Rotax 582 9.45 kg/kW (15.53 lb/hp)
Rotax 912 UL 8.38 kg/kW (13.77 lb/hp)

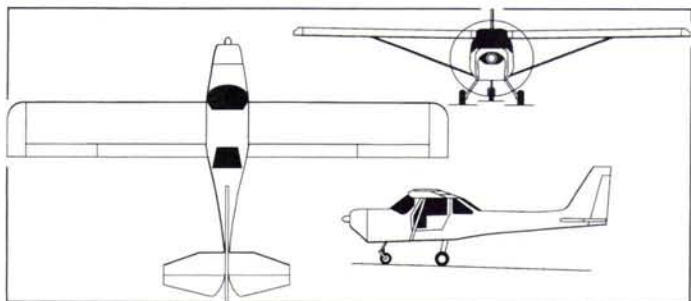
PERFORMANCE (A: solo at 317.5 kg; 700 lb T-O weight, B: at MTOW):

Never-exceed speed (VNE): A, B 86 kt (160 km/h; 100 mph)
Cruising speed: A, B 70 kt (129 km/h; 80 mph)
Stalling speed: A 35 kt (65 km/h; 40 mph)
B 38 kt (70 km/h; 43 mph)
Best angle of climb speed: A 39 kt (72 km/h; 45 mph)
B 42 kt (77 km/h; 48 mph)
Max rate of climb at S/L: A 305 m (1,000 ft)/min
B 229 m (750 ft)/min
Service ceiling: A, B 3,810 m (12,500 ft)
T-O run: A 37 m (120 ft)
B 92 m (300 ft)
T-O to 15 m (50 ft): A 77 m (250 ft)
B 138 m (450 ft)
Landing run: A 92 m (300 ft)
B 122 m (400 ft)
Range with max fuel, 65% power, no reserves:
A, B 285 n miles (527 km; 328 miles)
g limits +5.0/-2.5



Aspects of SkyGear Comet SP

1158641



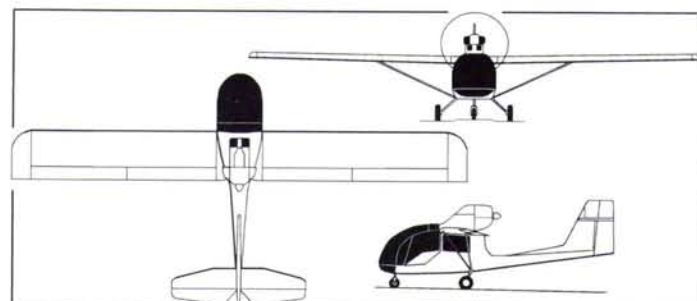
SkyGear Comet SP LSA (Paul Jackson)

1158578



SkyGear Albatross

1158802



SkyGear Albatross general arrangement (Paul Jackson)

1158762

SKYGEAR BIKINI

TYPE: Side-by-side ultralight kitbuilt.

PROGRAMME: Being promoted in 2006.

COSTS: Kit USD15,950; fully assembled (minus engine) USD19,950 (2006).

Description and data as for Albatross except for the following:

DESIGN FEATURES: As for Albatross except for shorter-span wings, without flaps, and omission of third seat.

POWER PLANT: Rotax 582 standard; Rotax 503 optional

DIMENSIONS, EXTERNAL:

Wing span 9.14 m (30 ft 0 in)

Wing aspect ratio 7.2

Length, wings folded 6.30 m (20 ft 8 in)

AREAS:

Wings, gross 11.61 m² (125.0 sq ft)



SkyGear Bikini general arrangement (Paul Jackson)

115876.3



Views of SkyGear Bikini and Albatross with Junkers ailerons

1158806

Lithuania

HELISOTA

HELISOTA LAK-X

5 Europos Avenue, LT-46329 Kaunas

Tel: (+370 37) 42 16 37

Fax: (+370 37) 42 04 20

e-mail: helisota@helisota.lt

Web: www.helisota.it

DIRECTOR GENERAL: Josif Legenzov

DIRECTOR, COMMERCE: Vladimir Tokmakov

DIRECTOR, INTERNATIONAL SALES: Anatolij Legenzov

DIRECTOR, PRODUCTION: Vaclovas Kliunka

Helisota's principal business is maintenance, repair and overhaul of helicopters and some types of general aviation and light transport aeroplanes. However, in 2004 it announced plans to return to production the indigenous LAK-X lightplane; the company confirmed this was the case in 2006.

HELISOTA LAK-X

TYPE: Side-by-side kitbuilt

PROGRAMME: Design started by Aeroplastika June 1988: construction of prototype LAK-XE (LY-XMH) begun by Avia Baltika in January 1990; first flight 2 August 1992 with 50.7 kW (68 hp) Limbach L 1700 engine; prototype displayed at Moscow Air Show 1993; later updated with 65 kW (87 hp) Limbach L 2400; horn balance added to rudder; three (one XE, two XA) completed by January 1996; first customer delivery (second XA prototype) May 1995; Avia Baltika pursued ground and flight test programme for JAR-VLA certification, and intended to produce kits and/or complete aircraft. Programme lapsed in late 1990s; revived in 2004 but as low priority.

CURRENT VERSIONS: **LAK-XA (American):** Continental IO-240 engine, although second LAK-X fitted with PZL-Franklin 4A-235B3 engine to US order.

LAK-XE (European): With choice of three engines, each of less than 74.6 kW (100 hp). CUSTOMERS: Six reportedly built by Avia Baltika, of which two to USA (currently N8023J and N17ED).

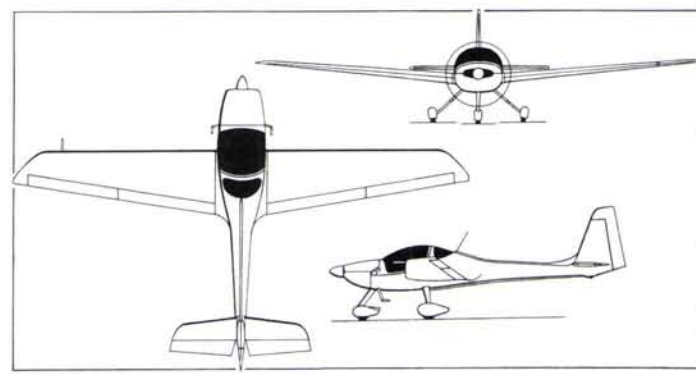
DESIGN FEATURES: Objectives were short field capability, high L/D range, good fuel economy and cabin comfort. Mid-mounted high-aspect ratio wing; laminar flow NACA 64 series aerofoil, thickness 15 per cent at root, 12 per cent at tip, with 6° dihedral, 4° incidence and 2° twist; fuselage of oval cross-section. Wings detachable for storage.

FLYING CONTROLS: Conventional and manual. Elevators and ailerons actuated by rods/levers, rudder by cables; electrically actuated flaps, maximum deflection 3° up at high cruising speed, 40° down for landing; aileron/flap mixer deflects ailerons 10° down with maximum flap deflection; electrically actuated elevator trim.



Avia Baltika-built LAK-X

(8) 1:109



1 AK-X two-seat lightplane (*Mike Keen*)

0589204

Trailing-edge flaps (total)	1.04 m ² (11.19 sq ft)
Fin	1.48 m ² (15.93 sq ft)
Rudder	0.71 m ² (7.64 sq ft)
Tailplane	2.40 m ² (25.83 sq ft)
Elevators (total)	0.86 m ² (9.26 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped: XA	460 kg (1,014 lb)
XE	400 kg (882 lb)
Max T-O weight: XA	750 kg (1,653 lb)
XE	650 kg (1,433 lb)
Max wing loading: XA	62.2 kg/m ² (12.75 lb/sq ft)
XE	53.9 kg/m ² (11.05 lb/sq ft)
Max power loading: XA	8.05 kg/kW (13.22 lb/hp)
XE	9.38 kg/kW (15.41 lb/hp)
PERFORMANCE:	
Max level speed at S/L:	
XA	135 kt (250 km/h; 155 mph)
XE	108 kt (200 km/h; 124 mph)

Max cruising speed: XA	118 kt (220 km/h; 136 mph)
XE	97 kt (180 km/h; 111 mph)
Econ cruising speed: XA	108 kt (200 km/h; 124 mph)
XE	86 kt (160 km/h; 99 mph)
Stalling speed:	
flaps up: XA	51 kt (95 km/h; 59 mph)
XE	46 kt (85 km/h; 53 mph)
flaps down: XA	44 kt (82 km/h; 51 mph)
XE	40 kt (75 km/h; 47 mph)
Max rate of climb at S/L: XA	300 m (984 ft)/min
XE	240 m (787 ft)/min
Service ceiling: XA, XE	2,000 m (6,560 ft)
T-O run: XA, XE	150 m (495 ft)
Landing run: XA	150 m (495 ft)
XE	100 m (330 ft)
Range with max payload and max fuel:	
XA, XE	459 n miles (850 km; 528 miles)
g limits: XA	+4/-2

Malaysia

AERONIMBUS

AERONIMBUS AIRCRAFT SDN BHD

Kuala Lumpur
Tel/Fax: (+60 3) 20 93 32 05
e-mail: info@aeronimbus.com
Web: www.aeronimbus.com
CEO: Ma. Yee Choong
SENIOR VICE-PRESIDENT: Rohisan bin Abdul Rehman

AeroNimbus is international partner with Dirgantara of Indonesia in development of the NMX-1 six-passenger light business jet (which see). Company was formed in 2003, and by late 2005 had workforce of over 100 (80 at factory in Indonesia, 25 in Malaysia and small numbers in Singapore and Thailand).

CTRM

COMPOSITES TECHNOLOGY RESEARCH MALAYSIA SDN BHD

T-02, Third Floor, 2310 Century Square, Jalan Usahawan, 63000 Cyberjaya, Selangor Darul Ehsan
Tel: (+60 3) 83 13 51 00
Fax: (+60 3) 83 13 51 11
e-mail: asmuni@ctrm.com.my
WORKS: Batu Berendam, Melaka
CEO: Col (Retd) Rosdi bin Mahmud
COO: Francis Hiew Nyuk Fah
HEAD OF CORPORATE MARKETING: Mohd Hezri Ashraf
CORPORATE COMMUNICATIONS MANAGER: Mrs R Charmaine

Incorporated in November 1990, CTRM became an investor in Eagle Aircraft of Australia, via its subsidiary CTRM Aviation, formerly known as Eagle Aircraft (M) Sdn Bhd; component production for the two-seat Eagle 150B began in 1997, subsequently progressing to full local manufacture. This was undertaken in a 20,903 m² (225,000 sq ft) facility at Melaka (Malacca) by CTRM's wholly owned subsidiary CTRM Aero Composites (CTRM AC), formerly known as Aero-Composites Technologies Sdn Bhd. All Eagle production was transferred to Malaysia following closure of the Australian factory at the end of February 2002, but ceased at the end of 2005. CTRM also had an 18 per cent investment in The Lancar Company, USA, for which CTRM AC produced composites fuselages for the Lancar Columbia 300; however, this work also ended in late 2005 after CTRM transferred more than half its holding in Lancar to the Malaysian government, reducing its own stake to less than 7 per cent. It also is under contract to BAE Systems to produce composites wing leading- and trailing-edge panels for the Airbus A300, A318/319/320/321 and A380, the 1,000th set being handed over to BAE on 8 December 2005. A EUR12.7 million contract was received from Sonaca on 22 June 2006 for main landing gear doors for the Airbus A400M.

CTRM's associate company Excelnet Sdn Bhd offers engineering solutions ranging from conceptual design to digital mockups and strength/stress analysis. It was involved, with CTRM and BAE Systems, in developing the optionally piloted Eagle 150 Airborne Reconnaissance Vehicle (ARV), details of which are given in *Jane's Unmanned Aerial Vehicles and Targets*. Other work has included wing life extension (spar modification) for the Scottish Aviation Bulldog, for which it has worldwide type certificate maintenance. In late 2003, CTRM and Eurocopter signed an agreement under which the former is overhauling and modifying up to 80 former German Army BO 105 helicopters for EMS and various military roles over the ensuing five years. Initial batch comprises 30 aircraft.

CTRM AVIATION SDN BHD

(Subsidiary of CTRM)
POSTAL ADDRESS: Locked Bag 1028, Pejabat Pos Besar, 75150 Melaka
Tel: (+60 6) 317 03 48
Fax: (+60 6) 317 70 23
e-mail: razak.zin@ctrmeagle.com
CEO: Abdul Malek Packeer
CONTACT: Abd Razak Mohamed Zin

WORKS: Composites Technology City, Batu Berendam Airport, 75350 Melaka
Tel: (+60 6) 317 10 07
Fax: (+60 6) 317 10 23

Formerly known as Eagle Aircraft (Malaysia) Sdn Bhd, CTRM Aviation was established in the mid-1980s to develop and manufacture a new light aircraft, also named Eagle, for the general aviation market. In 1993 it became a wholly owned subsidiary of CTRM, and overall owner (28 May 1993) of Eagle Aircraft Pty Ltd of Australia, where the aircraft was initially produced and/or assembled. Responsibility for the Eagle reverted to Malaysia following February 2002 closure of the Australian factory. Malaysian factory, completed March 1996, has floor area of 24,080 m² (259,200 sq ft).

CTRM EAGLE 150

TYPE: Two-seat lightplane.

PROGRAMME: Launched 1981 with objective of producing first all-composites light aircraft in Australia; single-seat POC (proof-of-concept) aircraft now displayed at Power House Museum, Sydney; construction of two-seat preproduction prototype Eagle X started fourth quarter 1987; first flight (VH-XEG) second quarter 1988, with 58 kW (78 hp) Aeropower engine, replaced later by 74.5 kW (100 hp) Continental O-200; 200 hour test programme, meeting all original design criteria, completed by October 1988; plans for 1989 production start aborted; component manufacture began March 1991; production prototype (PPT1/VH-XEP) made first flight 6 November 1992; weight-restricted certification by Civil Aviation Safety Authority of Australia (CASA) 21 September 1993; European JAR-VLA certificate not awarded at that time and aircraft consequently redesigned with changes including increased span and chord on foreplane and mainplane flaps; redesigned and repositioned wing cuffs, with leading-edge extension outboard; vortex generators and redesigned horizontal stabiliser aerofoil section.

Series production in Australia, as Eagle X-TS, launched August 1993; first flight (VH-AHH) 23 October 1993 and first customer delivery December 1993 (VH-FPO to Department of Conservation and Land Management in Western Australia). Initial production in Australia only, but using some components manufactured by Eagle Aircraft (Malaysia) of which Eagle Aircraft Pty Ltd was a wholly owned subsidiary. First Series 150 (converted production prototype VH-XEP) rolled out August 1997; certified on 13 November 1997 by CASA to JAR-VLA standards at MTOW of 640 kg (1,411 lb); this certification also valid in Malaysia. FAA certification achieved 11 February 1999, followed by New Zealand approval in mid-1999; also approved in Thailand. First night VFR instrumented aircraft certified and delivered in December 2000.

First aircraft completed from Malaysian components (VH-PMI, c/n MA 00001) made maiden flight 27 March 2001. In December 2001 it was announced that production was moving to Malaysia and operations in Australia were being run down; this was achieved in late February 2002 and type certificate transferred to Eagle Aircraft Malaysia on 30 May 2002 and CTRM Aviation on 1 January 2004. Malaysian production ceased in late 2005.

CURRENT VERSIONS: **Series 100:** Retrospective designation of former Eagle X-TS; production completed. Ten Series 100/Eagle X-TS built, including two for Malaysia (c/n 0003 and 0005) and one for John Roncz in USA (c/n 0010); five conversions (c/n 0002/3/5/7/8) to Series 150.

Series 150: Main production version, designated **150A** with IO-240-A engine and **150B** with IO-240-B. Engines have same maximum power of 93.2 kW (125 hp), but B version has increased mid-range power of almost 29 per cent to 69.4 kW (93 hp) and is 3.7 per cent quieter than A model. Available in Basic, Training and Executive variants, as below. US promotion devoted to 150B version only, this being sole variant with FAA certification.

Basic: Standard Series 150 version; as described.

Training: As Basic, with addition of tachometer, turn co-ordinator, directional gyro, digital clock, cockpit internal lighting, transponder, nav/com/VOR, navigation and landing lights and Eagle external pinstriping and decals.

Executive: As Training, plus GPS moving map display, mainwheel spats, leather upholstery, cabin heater, baggage bins, sun visor and chart pocket.



CTRM Eagle 150 (Paul Jackson)

1159170

Eagle ARV: Optionally piloted surveillance version (Aerial Reconnaissance Vehicle), co-developed by CTRM with BAE Systems Controls of California, which supplied complete modification kit including flight management system, sensor payload, datalink and ground control station. One four-aircraft system delivered to Royal Malaysian Air Force in late 2001. Further details in *Jane's Unmanned Aerial Vehicles and Targets*.

CUSTOMERS: Series 150 operators in Australia, Malaysia, New Zealand, USA and elsewhere. By January 2003, production (including Eagle X-TS) totalled 46 in Australia (including two prototypes), of which 42 to customers in Australia, New Zealand and USA (two). At least 14 from Malaysian production by early 2005, comprising four ARVs for RMAF, seven Series 150s for Malaysian Flying Academy and four for ESB Flying Club.

TAG

THE AIRSHIP GROUP

1 Alom Way, Sama Jaya Free Industrial Zone, Muara Tabuan, 93450 Kuching
Tel: (+60 82) 36 53 33
Fax: (+60 82) 36 73 33
e-mail: info@airships.cc
Web: www.airships.cc
PRESIDENT: Philip Yinn

TAG established on Sarawak in 1988 and is now a diversified high-technology industry group with four divisions, including two in aerospace services:

Airship Group: Comprising Airship Systems Sdn Bhd, Airship Concepts Sdn Bhd and Airview Services Sdn Bhd

Aerospace City: Comprising LTA Solutions Sdn Bhd, Airview Services Sdn Bhd and Academy Sdn Bhd

Alom Group: Construction projects

Technology Incubators: R&D

Development of new projects is responsibility of Airship Concepts; manufacture by Airship Systems; support by Airview Services.



LTA sector of Aerospace City, planned by TAG's Airship Group

1121900

In October 2003, TAG acquired (for EUR13,500) the former CargoLifter 'Joey' prototype which, in 2004, was being modified to serve as a publicity vehicle. No further news of this had emerged by mid-2006. Other products include inflatable hangars and aerostats for various applications.

TAG AG SERIES

TYPE: Helium semi-rigid airship.

PROGRAMME: Range of new-generation airships under development, as described below.

CURRENT VERSIONS: **AG22U:** Remotely piloted, 22 m (72.2 ft) long unmanned airship. In flight test by April 2004 and expected to enter service by mid-year.

AG33mu: Manned technology demonstrator, 33 m (108.3 ft) long, with pilot-controlled mooring system and other innovative capabilities. Under construction in 2004, but no news of any progress by mid-2006.

AG45: Under consideration in late 2004; possibly as alternative manned technology demonstrator to AG33. Length 45 m (148 ft).

AG90: 90 m (295.3 ft) long semi-rigid, able to carry up to 50 passengers. Design under way in early 2004; said then to be built later that year for 'a regional government' but apparently not accomplished.

AG90DB: Hybrid, twin-hull vehicle project for ultra-large payloads and with partial aerodynamic lift.

AG100L: Lenticular design for logging industry and other aerial crane roles.

AG180: Projected heavy-lift semi-rigid, 180 m (590.6 ft) long and having 50 tonne payload capacity.

AG300: Projected stratospheric airship with ultra-long endurance.

DESIGN FEATURES: Conventional-shape envelope (except AG100L), and twin tailfins with elevators. Twin rear-mounted propulsion engines, located within tailfins. Third engine, mounted within bow, provides multidirectional thrust vectoring for directional control and terminal guidance for mooring system.

AVIONICS: Fly by light, developed by TAG.



TAG AG22 unmanned trials airship in 2004

1121918

Netherlands

DAC

DUTCH AEROPLANE COMPANY VOF

Pieter Zeemanweg 116, NL-3316 GZ Dordrecht
WORKS: Laan van Ypenburg 46, NL-2497 GB Den Haag
Tel: (+31 6) 54 94 15 32
Web: www.dac-ranger.nl

DIRECTORS:

Evert-Jan Cornet (Information)

Jan Laurier (Technical)

DAC was established in 1999 to produce what is now known as the RangerR.

DAC RANGER

TYPE: Side-by-side kitbuilt.

PROGRAMME: Based on Opel-powered Diesels PL2 (F-PTD), built in France by Paul Lucas and Serge Pennec, first flown September 1998, and shown at PFA International Rally, Cranfield, UK, in July 1999, where selected as basis of DAC venture. Martin Hollmann of US company ADI contracted by DAC to transform wood/composites Diesels into RangerR, with changes to structure, fuselage size and wing section. Alex Swagemakers of TTE redesigned Opel 1.7 litre turbo-diesel engine for aeronautical use. Incomplete RangerR prototype (PH-DAC) exhibited at Aero '03, Friedrichshafen, April 2003; first flight then due in USA later in 2003 but this still had not taken place by late 2004 due to design change requirements; in September 2004 the company announced that flight testing would take place in the Netherlands. Taxiing tests at de Kooy began on 24 September 2005, and first flight followed on 15 September 2006.

COSTS: Marketed as fast-build kit, with customer's build-assistance option. Estimated kit cost EUR45,000 (2006), including engine and propeller, but excluding avionics.

DESIGN FEATURES: Objectives of RangerR redesign included JAR-VLA conformity, low construction cost, Diesel power, long range and easily disconnected wings for road transport and storage. Low, moderately tapered wing and tailplane; sweptback fin; upturned wingtips; fuselage tapers sharply forward and rear of cockpit. Ventral strake.

FLYING CONTROLS: Conventional and manual. Horn-balanced rudder and single-piece elevator. Flaps: maximum deflection 30°.

STRUCTURE: Composites throughout. Fuselage in left and right halves bonded together, with fin ribs, wing spar bulkheads and firewall pre-installed. Wing main spars glued to bottom skin; forward ribs pre-positioned. Metal engine mount.

LANDING GEAR: Tricycle type; fixed. Cantilever main legs; speed fairings on all wheels.

POWER PLANT: Initially to be one Opel Corsair Y17DT Diesel engine, with turbocharger and intercooler, rated at 67.1 kW (90 hp) at 4,000 rpm, driving a GT GT-2/174/VQS two-blade, wood/composites, fixed-pitch propeller via a 1:1.67 reduction gear. Later changed to 67.1 kW (90 hp) Isuzu 1686 CCM turbo-diesel engine with turbocharger and intercooler driving a three-blade fixed-pitch propeller via 1:1.66 reduction gear; variable-pitch propeller optional. Fuel capacity 100 litres (26.4 US gallons; 22.0 Imp gallons).

ACCOMMODATION: Two persons, side by side beneath single-piece canopy/windscreen; two rear windows.

AVIONICS: To customer's specification.

DIMENSIONS, EXTERNAL:

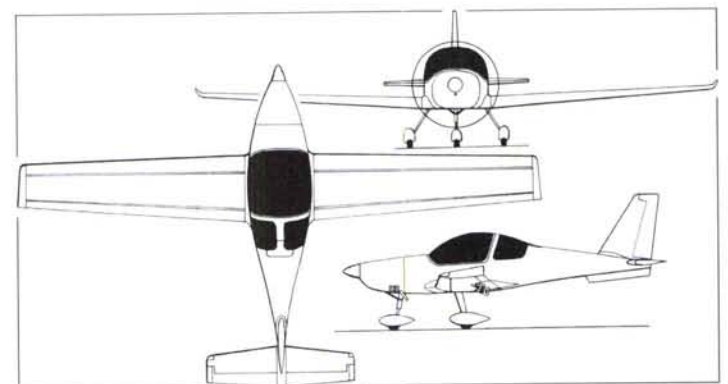
Wing span	9.75 m (31 ft 11 3/4 in)
Wing aspect ratio	9.3
Length overall	5.87 m (19 ft 3 in)
Propeller diameter	1.74 m (5 ft 8 1/2 in)

DIMENSIONS, INTERNAL:

Cabin max width	1.15 m (3 ft 9 1/4 in)
-----------------------	------------------------

AREAS:

Wings, gross	10.24 m ² (110.2 sq ft)
--------------------	------------------------------------



DAC RangerR two-seat composites lightplane (James Goulding)

1154683

WEIGHTS AND LOADINGS (estimated):

Weight empty	500 kg (1,102 lb)
Max T-O weight	750 kg (1,653 lb)
Max wing loading	73.2 kg/m ² (15.00 lb/sq ft)
Max power loading	11.18 kg/kW (18.36 lb/hp)

PERFORMANCE (estimated):

Max level speed at FL120	150 kt (278 km/h; 173 mph)
Cruising speed at FL80	132 kt (244 km/h; 152 mph)
Stalling speed: flaps up	49 kt (89 km/h; 56 mph)
flaps down	44 kt (81 km/h; 51 mph)
T-O run	153 m (500 ft)
Landing run	134 m (440 ft)
Range	1,241 n miles (2,300 km; 1,429 miles)



DAC RangeR making its first flight

1040557

SSVOBB

STICHTING STUDENTEN VliegTUGONTWIKKELING -BOUW EN -BEHEER

FOUNDATION FOR STUDENT AIRCRAFT DEVELOPMENT, MANUFACTURING AND OPERATION
Kluyverweg 1, NL-2629 HS Delft
Tel: (+31 15) 278 10 57
Fax: (+31 15) 278 12 43
e-mail: ssvobb@lr.tudelft.nl
Web: www.lr.tudelft.nl
CHAIRMAN: Thomas van de Lagemaat
SECRETARY: Jasper van 't Hoff
TREASURER: Flip Sondervan

IMPULS PROJECT:
PRODUCTION CO-ORDINATOR: Bastiaan Konneman
ENGINEERING CO-ORDINATOR: Kim Rogiers

SSVOBB was formed in 1990 by The Society of Aerospace Students 'Leonardo da Vinci' of the Delft University of Technology, Faculty of Aerospace Engineering. Its main objective is to co-ordinate the design, manufacture and maintenance of aircraft by students. A replica of the 1937 Lambach HL II aerobatic biplane was constructed between 1989 and 1995, and work is proceeding on an original lightplane design, the Impuls. The projects are financed by funds and sponsorship; in January 2006 Pratt & Whitney donated USD15,000 to the project.



Artist's impression of SSV OBB Impuls

1139053

SSVOBB IMPULS

TYPE: Two-seat lightplane.

PROGRAMME: Preliminary design started early 1994. Registration PH-VXM reserved March 1997. Main fuselage moulds completed early 1999. Main wings due to be completed by mid-2001, but this has slipped to 2005 due to redesign work; by early 2004 wing covering samples were being produced, with intention of producing final version in 2005. The landing gear was completed by Grove Aircraft, California. In mid-2004 a new wind tunnel model was under construction; this is being redesigned and was to have been completed by end 2005. Certification to CS 23 being undertaken under supervision of Prof dr ir Theo van Holten (flight performance); Prof dr ir J A Mulder (stability/control); and Prof dr ir MJL van Tooren (systems and structures).

DESIGN FEATURES: Twin-boom layout with pod-type fuselage and high wing of parallel chord; swept fins.

FLYING CONTROLS: Conventional and manual. Actuation by pushrods (ailerons and elevator), with cable and pushrod interconnected twin rudders. Servo-actuated electric pitch trim and electrically operated single-slotted flaps.

STRUCTURE: All-composites wing with GFRP sandwich skin and spars; GFRP tail unit. Some GFRP parts will be produced by vacuum assisted resin injection process. Fuselage steel tube frame with glass fibre shell will be used to finalise design of cockpit and control systems. Wing section NACA 63,415 with RA163CW3 flaps; twin tailbooms joined by NACA 0012 section horizontal stabiliser.

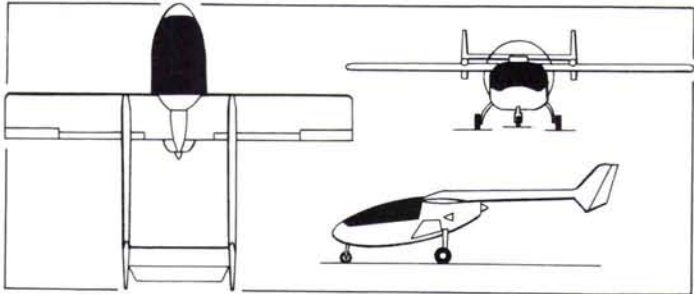
LANDING GEAR: Non-retractable tricycle type; aluminium cantilever sprung mainwheels. Non-steerable nosewheel; mainwheels have 45 cm (17 3/4 in) tyres pressurised to 3.14 bar (45.5 lb/sq in). Hydraulically operated brakes on mainwheels.

POWER PLANT: One 74.6 kW (100 hp) Diamond GIAE110R rotary engine driving a three-blade fixed-pitch propeller. Fuel capacity 65 litres (17.2 US gallons; 14.3 Imp gallons) in single tank located between cockpit and engine. Oil capacity 3.0 litres (0.8 US gallon; 0.7 Imp gallon).

ACCOMMODATION: Side-by-side seating for pilot and passenger under one-piece, Perspex canopy. Baggage space behind seats.

DIMENSIONS. EXTERNAL:

Wing span	7.75 m (25 ft 5 in)
Wing chord, constant	1.03 m (3 ft 4 1/2 in)
Wing aspect ratio	7.5
Length overall	6.37 m (20 ft 10 3/4 in)
Fuselage: Length	3.32 m (10 ft 10 3/4 in)
Max width	1.20 m (3 ft 11 1/4 in)
Height overall	2.15 m (7 ft 0 3/4 in)
Tailplane span	2.10 m (6 ft 10 3/4 in)
Wheel track	2.20 m (7 ft 2 1/2 in)
Wheelbase	1.75 m (5 ft 9 in)
Propeller diameter	1.50 m (4 ft 11 in)



SSVOBB Impuls (Diamond rotary engine) (Paul Jackson)

0051122

AREAS:

Wings, gross	8.00 m ² (86.1 sq ft)
Ailerons (total)	0.66 m ² (7.10 sq ft)
Flaps (total)	1.06 m ² (11.41 sq ft)
Fins (total)	2.00 m ² (21.53 sq ft)
Rudders (total)	0.24 m ² (2.58 sq ft)
Tailplane	1.51 m ² (16.25 sq ft)
Elevators (total)	0.62 m ² (6.67 sq ft)

WEIGHTS AND LOADINGS (estimated):

Weight empty	375 kg (827 lb)
Baggage capacity	30 kg (66 lb)
Max T-O weight	575 kg (1,267 lb)
Max wing loading	71.9 kg/m ² (14.72 lb/sq ft)
Max power loading	7.71 kg/kW (12.67 lb/hp)

PERFORMANCE (estimated):

Max level speed at S/L	124 kt (230 km/h; 142 mph)
Max cruising speed	113 kt (210 km/h; 130 mph)
Stalling speed	52 kt (96 km/h; 60 mph)
Max rate of climb at S/L	246 m (807 ft)/min
T-O to 15 m (50 ft)	340 m (1,115 ft)
Landing from 15 m (50 ft)	430 m (1,410 ft)
Range with max fuel	more than 378 n miles (700 km; 435 miles)
Endurance	5 h
g limits	+4.4/-2.2

New Zealand

ALPHA

ALPHA AVIATION LTD

Ingram Road, Hamilton International Airport, RD2 Hamilton 2021

Tel: (+64 7) 843 70 70

Fax: (+64 7) 843 80 40

e-mail: sales@alphaaviation.co.uk

Web: www.alphaaviation.co.nz

MANAGING DIRECTOR: Richard Sealy

CHAIRMAN: Graeme Edwards

DIRECTORS:

Richard Izard

Tony Noun

John Birch

Barry Colman

CEO: Murray Dreyer

COO: Graeme Edwards

MARKETING & DISTRIBUTION MANAGER: Steve Lange

Alpha established December 2003 to build Robin R 2120/2160 Alpha primary trainer in 14,000 m² (150,700 sq ft) new plant, employing up to 50 workers, at Hamilton. On 25 June 2004 announced imminent conclusion to purchase of rights, jigs and tools from Apex Aviation in France, anticipating first deliveries in 2005 and production build-up to 100 per year. Transfer of rights effected 8 October 2004 and production jigs and tools arrived in New Zealand in January 2005. Intended completion of first aircraft in April 2005 postponed, manufacture taking place in temporary premises at Ingram Road following rejection of planning application for new site at Middle Road. Izard Pacific Aviation is shareholder, with HA Investments, Hammersmith Holdings and Hansen Aviation Services.

ALPHA 120

TYPE: Primary prop trainer/sportplane.

PROGRAMME: Derived from original Robin HR 200-120B, which had first flown (as HR 200-125 prototype F-WSQP) on 29 July 1971 and was built in France through much of 1970s in several subvariants; returned to production in 1993 with minor modifications as HR 200-120B. Final example of this version built in late 2000, by which time Robin 2120 and 2160 were in production.

R 2120 announced in early 2001. Combines fuselage, vertical tail surfaces, fuel capacity and power plant of Robin HR 200-120B with wings and horizontal tail surfaces of R 2160. Prototype (F-WZZX) completed mid-2000; demonstrator (F-WZZY) shown at Aero '01, Friedrichshafen, April 2001. First production aircraft (EC-HMG) to Spain by early 2001.

At Aero '03, in Friedrichshafen, Robin exhibited a fuselage mockup of an HR200 variant with Thielert Centurion 1.7 diesel engine driving a three-blade MTV-6-A/187-129 propeller; no details of planned production were given.

Design rights acquired in 2004 by Alpha Aviation of New Zealand. R 2120 became Alpha 120. Target production rate up to 100 aircraft per year, with most components being sourced from local suppliers. New Zealand Civil Aviation Authority validated type certificate A-15 on 16 June 2006, covering HR 200 and R 2000-series and replacing EASA TC No. 70.

CURRENT VERSIONS: **HR 200-100:** Lycoming O-235-H2C engine.

HR 200-100S: As -100, but no wheel fairings or propeller spinner.

HR 200-120: As -100, but O-235-J2A engine.

HR 200-120B: As -120, but modified stabilator and disc brakes.

HR 200-160: As -100, but O-320-D engine.

R 2160: Aerobatic. As HR 200-160, but new wing section, ailerons and flaps; enlarged rudder with underfin.

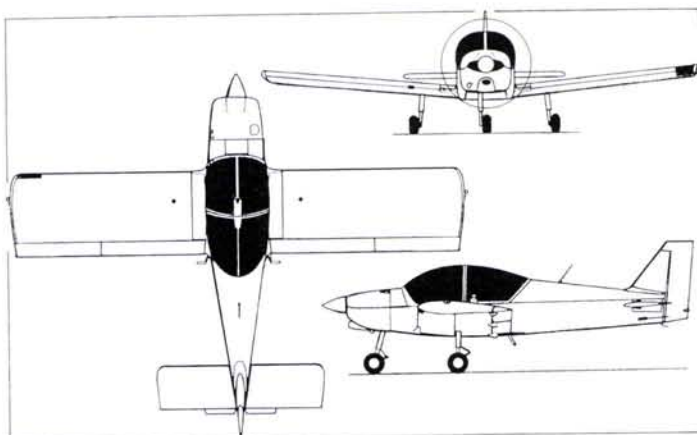
R 2100: Aerobatic. As R 2160, but O-235-H2C engine; no wheel fairings or spinner if fitted with McCauley 1A-105BCM 70-56 propeller.

R 2100A: Aerobatic. As R 2100, but increased weight and revised propeller; spinner and wheel fairings fitted.



Robin-built HR 200-120 (Paul Jackson)

1158290



Alpha 120T primary trainer (Paul Jackson)

1128989

R 2160D: Aerobatic; German market. Engine limited to 2,600 rpm for noise reduction.
R 2112: Aerobatic. As R 2100, but O-235-L engine with revised air intake and increased weight.

R 2160i: Aerobatic. As R 2160, but AEIO-320-D2B with inverted fuel and oil systems.

R 2120U: Non-aerobatic. As R 2112, but O-235-L2A, small rudder, no underfin and no wheel fairings.

Alpha 120T: Marketing designation of initial New Zealand version.

CUSTOMERS: Combined 340 HR 200/R 2120/R 2160s built by late 2005, including two in 2004 and one in 2005 (F-HAPC) from remaining French components. French exports in Australia, Belgium, Canada, Denmark, Finland, Germany, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, Thailand, UK and USA. Alpha Aviation expects to export 90% of its production.

ROBIN HR 200-SERIES PRODUCTION

Version	First aircraft	Year	Quantity	
			First series	Second series
HR 200-125 Club	F-WSQP	1971	1	
HR 200-100 Club	F-WSQR	1975	71	
HR 200-100B Club	F-BVYA	1974	1	
HR 200-100S Club	F-BXJS	1976	10	
HR 200-120 Club	F-BXEV	1975	4	
HR 200-120B	F-WUQB	1974	16	70
HR 200-160 Acrobin	F-WSQS	1974	4	
R 2160 Alpha Sport	F-WZAC	1976	1	
R 2100	F-GAVE	1977	6	
R 2100A Club	F-GAVD	1977	24	
R 2112 Alpha	F-GBAL	1978	10	1
R 2112A	EI-BIU	1980	1	
R 2160 Alpha Sport	F-GAOR	1977	46 ¹	24
R 2160 Acrobin	OO-VLU	1977	4	
R 2160D Acrobin	F-GAOL	1977	11	3
R 2160LC	F-WZZX	1996		1
R 2000-120	F-GSIU	1996		1
R 200-160	HB-KFA	1999		3
R 2160i	HS-TPA	1999		7
R 2120U	F-WZZX	2000		18
R 2160U	F-WQPO	2002		1
unknown			1	
Subtotal			211	129
Total				340

¹ Including 23 assembled in Canada

COSTS: NZD199,000 (2006).

DESIGN FEATURES: Low-mounted, constant-chord wing, sweptback fin and low, all-moving tailplane.

Wing section NACA 23015; dihedral 6° 20'; incidence 3° at root.

FLYING CONTROLS: Manual. Conventional fully balanced slotted ailerons and horn-balanced rudder without tabs. All-moving tailplane with anti-balance tabs each side. Electrically actuated slotted flaps.

STRUCTURE: Aluminium alloy wing spars and skinning; semi-monocoque fuselage. Anti-corrosion treatment standard.

LANDING GEAR: Non-retractable tricycle type with fairing, oleo-pneumatic shock-absorber and tyre (380x150) on each leg. Cleveland disc brakes on mainwheels. Nosewheel steering through rudder bar, self-centering in flight. Parking brake standard.

POWER PLANT: One 88.0 kW (118 hp) Textron Lycoming O-235-L2A flat-four engine, driving a Sensenich 72-CK6-054 two-blade, fixed-pitch aluminium propeller. Provisional design studies completed for installation of 134 to 149 kW (180 to 200 hp) engine. Christen 603 inverted oil system and inverted fuel system standard. Fuselage fuel tank, capacity 120 litres (31.7 US gallons; 26.4 Imp gallons).

ACCOMMODATION: Two seats side by side on fore-and-aft adjustable, six-position bucket seats; four-point harnesses standard. Dual controls (sticks) standard. Dual swivel-type fresh air vents, cabin heating system, windscreen defrost cabin lights, stereo headset sockets and map and storage pockets, all standard. Baggage compartment, with tiedown straps, behind seats, maximum capacity 34 kg (75 lb).

SYSTEMS: 14 V 24 Ah electrical system.

AVIONICS: Comms: Garmin GNC 250XL GPS/Com, Garmin GTX 327 transponder, SPA400 intercom and ELT, all standard.

Instrumentation: Artificial horizon, direction indicator, sensitive altimeter, ASI, VSI, magnetic compass, turn co-ordinator, OAT gauge and annunciator light panel, all standard.

EQUIPMENT: Landing, taxi, anti-collision and navigation lights, tinted canopy, tiedown points, towbar and white base coat paint with two trim colours, all standard.

DIMENSIONS: EXTERNAL:

Wing span	8.33 m (27 ft 4 in)
Wing aspect ratio	5.6
Wing chord, constant	1.555 m (5 ft 1 1/4 in)
Length overall	6.64 m (21 ft 9 1/2 in)
Tailplane span	3.04 m (9 ft 11 3/4 in)
Tailplane chord	0.725 m (2 ft 4 1/2 in)
Wheelbase	1.43 m (4 ft 8 in)
Propeller diameter	1.83 m (6 ft 0 in)

DIMENSIONS: INTERNAL:

Cabin max width	1.07 m (3 ft 6 in)
-----------------	--------------------

AREAS:

Wings, gross	12.50 m ² (134.5 sq ft)
Ailerons, total	1.06 m ² (11.41 sq ft)
Trailing-edge flaps, total	1.34 m ² (14.42 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	544 kg (1,199 lb)
Max T-O weight	800 kg (1,764 lb)
Max wing loading	64.0 kg/m ² (13.11 lb/sq ft)
Max power loading	9.09 kg/kW (14.94 lb/hp)

PERFORMANCE:

Cruising speed at 75% power at 2,591 m (8,500 ft):	104 kt (193 km/h; 120 mph)
Max rate of climb at S/L	192 m (630 ft)/min
T-O to 15 m (50 ft)	490 m (1,610 ft)

Landing from 15 m (50 ft) 480 m (1,575 ft)
 Range with max fuel 510 n miles (944 km; 586 miles)
 g limits +6/-3.5

ALPHA 160

TYPE: Aerobatic two-seat lightplane.

PROGRAMME: Certified in France as Robin R 2160 in mid-1978 and in USA (FAR Pt 23 Aerobatic and Utility category) 15 November 1982. Some aircraft assembled in Canada (1983-85). Production then ceased, but restarted in France January 1994; transferred to New Zealand in 2005; initial Antipodean production aircraft (ZK-FXY, c/n 160A-06001) first flew 12 April 2006.

CURRENT VERSIONS: Refer to Alpha 120 entry for evolution of earlier aerobatic versions.

Alpha 160A: Baseline version previously Robin R 2160, as described below.

Alpha 160Ai: Original Robin R 2160i certified 8 July 1998, with 119 kW (160 hp) Textron Lycoming AEIO-320-D2B fuel-injected flat-four. First two to CATC training college in Thailand, 1998.

CUSTOMERS: Total of over 133 sold in Europe, Australia, New Zealand, Canada and USA by late 2002, including 97 in first series. No known production in 2003, but one built in France for New Zealand in 2004. New Zealand production began in 2006. First significant order in May 2006 for 12 (plus 14 options) from CTC Aviation Flight School at Hamilton, New Zealand; three others for Waikato Aero Club and two to Southern Wings at Invercargill. COSTS: NZD249,000 (2006).

DESIGN FEATURES: Generally as Robin R 2120/Alpha 120T, but with extended rudder chord, underfin and other detail changes.

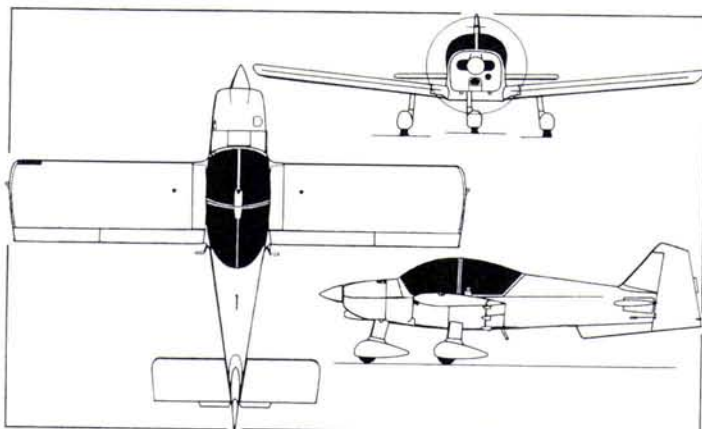
Wing section NACA 23015; dihedral 6° 20'; incidence 3° at root.

FLYING CONTROLS: Manual. Conventional fully balanced slotted ailerons and horn-balanced rudder without tabs. All-moving tailplane with anti-balance tabs each side. Electrically actuated slotted flaps.

STRUCTURE: Aluminium alloy wing spars and skinning; semi-monocoque fuselage. Anti-corrosion treatment standard.

LANDING GEAR: Non-retractable tricycle type with fairing, oleo-pneumatic shock-absorber and tyre (380x150) on each leg. Cleveland disc brakes on mainwheels. Nosewheel steering through rudder bar, self-centering in flight. Wheel fairings on all three wheels standard.

POWER PLANT: One 119 kW (160 hp) Textron Lycoming O-320-D2A flat-four engine, driving a Sensenich 74DM6S5-2-64 two-blade, fixed-pitch aluminium propeller; fuel-injected AEIO-320 in Alpha 160Ai. Christen 603 inverted oil system and inverted fuel system standard on Alpha 160Ai. Fuselage fuel tank, capacity 160 litres (42.3 US gallons; 35.2 Imp gallons). If operated in Utility category, optional fuel tank of 120 litres (31.7 US gallons; 26.4 Imp gallons).



Alpha 160A two-seat lightplane (Paul Jackson)

1128990



First Alpha-built Alpha 160, ZK-FXY

1158283

ACCOMMODATION: Two seats side by side on fore-and-aft adjustable, six-position bucket seats; five-point harnesses standard. Dual controls (sticks) standard.

SYSTEMS: 14 V 24 Ah electrical system.

AVIONICS: Comms: Garmin GNC 250XL GPS/com; GTX 327 transponder; PS Engineering PMA 4000 audio panel/intercom.

Custom options available.

EQUIPMENT: As for Alpha 120.

DIMENSIONS, EXTERNAL:

Wing span	8.64 m (28 ft 4 in)
Wing chord, constant	1.56 m (5 ft 1 1/4 in)
Wing aspect ratio	5.8
Length overall	7.10 m (23 ft 3 1/2 in)
Height overall	2.13 m (7 ft 0 in)
Tailplane span	3.03 m (9 ft 11 1/4 in)
Wheel track	2.91 m (9 ft 6 1/2 in)
Wheelbase	1.44 m (4 ft 8 1/2 in)
Propeller diameter	1.88 m (6 ft 2 in)

DIMENSIONS, INTERNAL:

Cabin: Max width	1.07 m (3 ft 6 in)
Height (seat cushion to canopy)	0.92 m (3 ft 0 1/4 in)

AREAS:

Wings, gross	13.01 m ² (140.0 sq ft)
--------------	------------------------------------

WEIGHTS AND LOADINGS:

Weight empty: 160A	585 kg (1,290 lb)
160T	595 kg (1,312 lb)
Max T-O weight: Aerobatic	800 kg (1,764 lb)
Utility	900 kg (1,984 lb)
Max baggage weight	35 kg (77 lb)
Max wing loading: Aerobatic	61.5 kg/m ² (12.59 lb/sq ft)
Utility	69.2 kg/m ² (14.17 lb/sq ft)
Max power loading: Aerobatic	6.71 kg/kW (11.02 lb/hp)
Utility	7.55 kg/kW (12.40 lb/hp)

PERFORMANCE (O-320 engine at Aerobatic max T-O weight):

Never-exceed speed (VNE)	180 kt (333 km/h; 207 mph)
Max level speed	138 kt (256 km/h; 159 mph)
Cruising speed:	
at 75% power	131 kt (241 km/h; 151 mph)
at 65% power	120 kt (222 km/h; 138 mph)
Stalling speed: flaps up	52 kt (96 km/h; 60 mph)
flaps down	46 kt (86 km/h; 53 mph)
Max rate of climb at S/L	314 m (1,030 ft)/min
Service ceiling (30.5 m; 100 ft/min rate of climb)	4,575 m (15,000 ft)
T-O and landing run	230 m (755 ft)
T-O to 15 m (50 ft)	574 m (1,883 ft)
Landing from 15 m (50 ft)	440 m (1,444 ft)
Range at 65% power:	
standard fuel	430 n miles (796 km; 494 miles)
optional fuel	558 n miles (1,033 km; 642 miles)
g limits	+6/-3

PAC

PACIFIC AEROSPACE CORPORATION LIMITED

Private Bag HN 3027, Hamilton Airport, Hamilton

Tel: (+64 7) 843 61 44

Fax: (+64 7) 843 61 34

e-mail: pacific@aerospace.co.nz

Web: www.aerospace.co.nz

CEO: Paul Hebbard

MANAGING DIRECTOR: Brian Hare

Pacific Aerospace Corporation formed 1982 following acquisition of assets and undertakings of New Zealand Aerospace Industries; became wholly owned subsidiary of AeroSpace Technologies of Australia (75.1 per cent) and Lockheed Martin, USA (24.9 per cent). In October 1995, Aeromotive, a privately owned New Zealand company, purchased ASTA's 75.1 per cent share, and became sole shareholder in 2001. PAC maintains production and support facilities for its own aircraft, the CT/4 Airtrainer series, Fletcher FU24 series, Cresco 08-600 and 08-750, and PAC 750XL; by late 2006, almost 600 aircraft had been produced. Cresco continued to be promoted in 2006, but last known aircraft was completed in August 2003. Manufacturing facility also produces items for the Airbus A330/340. Workforce of 165 employed in the company's 24,155 m² (260,000 sq ft) facility in mid-2004.

PAC AIRTRAINER CT/4E

Royal Thai Air Force designation: BF 16

TYPE: Primary prop trainer/sportplane.

PROGRAMME: New Zealand redesign of Australian Victa Airtrainer; first flight 23 February 1972; deliveries began October 1973; 94 (plus two prototypes) built before production ended 1977 (75 CT/4A and 19 special military variants); production line reopened 1991 to build 12 civil CT/4Bs for Ansett Flying College and six for Thailand; last completed August 1992. First flight of CT/4C turboprop prototype (ZK-FXM, converted RAAF CT/4B) 21 January 1991.

CURRENT VERSIONS: **T350:** Turboprop version (previously known as CT/4C) with 313 kW (420 shp) Rolls-Royce 250-B17D (throttle limited to 261 kW; 350 shp) in lengthened nose. Certification was expected 1998 in anticipation of Southeast Asian order for 30, but this failed to materialise. Some interest still being shown in this version.

CT/4E: Developed version of CT/4B with more powerful engine; wing mounted slightly farther forward than on CT/4B; first flight (ZK-EUN, converted from RAAF CT/4A) 14 December 1991; NZ certification (FAR Pt 23 Amendment 36) 8 May 1992.

Detailed description applies to CT/4E.

CUSTOMERS: PAC previously built 75 CT/4As and 38 CT/4Bs; further production of CT/4E began in 1997, of which 13 supplied on 20 year lease to the Royal New Zealand Air Force as replacements for CT/4Bs; contract signed 18 August 1998; first (NZ1985) delivered to Pilot Training Squadron at Ohakea in same month; last (NZ1997) on 8 June 1999; by late 2000 the fleet had accumulated 10,000 flying hours. Also used by Red Checkers aerobatic team. Thailand had requirement for 24 CT/4Es, initial order being for 12, deliveries of which began in July 1999 and were completed in June 2000 (final Thai aircraft of this batch first flew 11 May 2000). Further four Thai aircraft followed in August 2001 and eight more between mid-2004 and March 2005, completing 24 required. Two EFIS-equipped CT/4Es delivered to Singapore Youth Flying Club in June 2002. Total 40 (including demonstrator) built by early 2005; none further by late 2006.

DESIGN FEATURES: Metal translation of 1953-vintage wooden tourer. Conventional, low-wing lightplane. Tapered wings and constant-chord tailplane. Detachable wingtips to allow fitting of optional wingtip fuel tanks.

Wing section NACA 23012 (modified) at root, NACA 4412 (modified) at tip; dihedral 6° 45' at chord line; incidence 3° at root; twist 3°; root chord increased by forward sweep of inboard leading-edges; small fence on outer leading-edges.

FLYING CONTROLS: Conventional and manual. Aerodynamically and mass-balanced bottom-hinged ailerons and statically balanced one-piece elevator actuated by pushrods; rudder by rod and cable linkage; ground-adjustable tab on rudder, electric trim control for elevator and rudder; electrically actuated single-slotted flaps.

STRUCTURE: Light alloy stressed skin except for Kevlar/GFRP wingtips and engine cowling; ailerons and flaps have fluted skins.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring steel cantilever mainwheel legs; steerable (±25°) nosewheel carried on telescopic strut and oleo shock-absorber. Main units



PAC CT/4E Airtrainer (Paul Jackson)

1040373

have Dunlop Australia wheels and tubeless tyres size 15x6.00, pressure 1.65 bar (24 lb/sq in); nosewheel has tubeless tyre size 14x4.5, pressure 1.24 bar (18 lb/sq in). Single-disc toe-operated hydraulic brakes, with hand-operated parking lock. Minimum ground turning radius 2.90 m (9 ft 6 in). Landing gear designed to shear before any excess impact loading is transmitted to wing, to minimise structural damage in event of crash landing.

POWER PLANT: One 224 kW (300 hp) Textron Lycoming AEIO-540-L1B5 flat-six engine with inverted oil system; three-blade Hartzell HC-C3YF-4BF/FC7663-2R or MT-Propeller MTV-9 series constant-speed metal propeller. Standard fuel capacity of 204.4 litres (54.0 US gallons; 45.0 Imp gallons) of which 200 litres (52.8 US gallons; 44.0 Imp gallons) are usable; wingtip tanks, each of 77.6 litres (20.5 US gallons; 17.1 Imp gallons) capacity, available optionally. Gravity fuelling point in each wing. Oil capacity 11.4 litres (3.0 US gallons; 2.5 Imp gallons).

ACCOMMODATION: Two seats side by side under hinged, fully transparent jettisonable Perspex canopy. Space to rear for optional third seat or 77 kg (170 lb) of baggage or equipment. Dual controls standard.

SYSTEMS: 28 V DC electrical system; ground power receptacle. Air conditioning optional.

AVIONICS: Garmin GNS 430 GPS/nav optional.

DIMENSIONS, EXTERNAL:

Wing span	7.92 m (26 ft 0 in)
Wing chord; at root	2.18 m (7 ft 2 in)
at tip	0.94 m (3 ft 1 in)
Wing aspect ratio	5.2
Length overall	7.16 m (23 ft 5 3/4 in)
Height overall	2.59 m (8 ft 6 in)
Fuselage: Max width	1.12 m (3 ft 8 in)
Max depth	1.40 m (4 ft 7 1/4 in)
Tailplane span	3.61 m (11 ft 10 in)
Wheel track	2.97 m (9 ft 9 in)
Wheelbase	1.66 m (5 ft 5 1/2 in)
Min propeller ground clearance	0.20 m (8 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.74 m (9 ft 0 in)
Max width	1.08 m (3 ft 6 1/2 in)
Max height	1.34 m (4 ft 5 in)

AREAS:

Wings, gross	11.98 m ² (129.0 sq ft)
Ailerons (total)	1.07 m ² (11.56 sq ft)
Flaps (total)	2.10 m ² (22.60 sq ft)
Fin	0.78 m ² (8.44 sq ft)
Rudder, incl tab	0.58 m ² (6.26 sq ft)
Tailplane	1.51 m ² (16.24 sq ft)
Elevator	1.56 m ² (16.74 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	807 kg (1,780 lb)
Max fuel weight	149 kg (328 lb)

Max T-O weight	1,179 kg (2,600 lb)
Max wing loading	98.38 kg/m ² (20.15 lb/sq ft)
Max power loading	5.26 kg/kW (8.67 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	209 kt (387 km/h; 240 mph)
Max level speed at S/L	163 kt (302 km/h; 188 mph)
Cruising speed at 2,590 m (8,500 ft) at 75% power	150 kt (278 km/h; 173 mph)
Stalling speed at S/L: flaps up	60 kt (112 km/h; 69 mph)
flaps down	45 kt (84 km/h; 52 mph)
Max rate of climb at S/L: ISA	558 m (1,830 ft)/min
Service ceiling	5,550 m (18,200 ft)
Time to service ceiling	13 min
T-O run at S/L: ISA	183 m (600 ft)
Landing from 15 m (50 ft)	244 m (800 ft)
Landing run	169 m (553 ft)
Range at S/L with max fuel at 75% power, ISA, no reserves	520 n miles (963 km; 599 miles)
g limits	+6/-3

PAC 750XL

TYPE: Light utility turboprop.

PROGRAMME: Wide-body version of Cresco (described separately) with fuselage height overall raised 15 cm (6 in); design started January 2000 and prototype (ZK-XLA) firstflown 5 September 2001. Optimised for parachute jumping. Other fields of use include carriage of freight, passengers and geophysical survey equipment and special operations.

Preliminary tests showed need for leading-edge root glove and increase of maximum flap angle from 30° to 40°. Certification by NZ CAA was achieved on 23 July 2003 with IFR approval granted in July 2006; FAA certification on 10 March 2004, with IFR approval granted in October 2006. EASA certification achieved in April 2006.

In June 2004, PAC entered a joint venture with Mecachrome Inc of Canada whereby partly assembled aircraft will be shipped to Mecachrome's factory at Mirabel, near Montreal, for final assembly and delivery to North American customers. First thus completed was ZK-JPQ (c/n 112); public debut at AirVenture, Oshkosh, in July 2005. Target production rates for the Canadian operation are 12 in 2005, 24 in 2006 and 36 in 2007, rising to a maximum of 100 aircraft per year.

CUSTOMERS: Eighteen firm orders and 260 options held by early 2004. First production aircraft delivered to Great Lakes Skydiving Centre of Tapano, New Zealand. More than 20 registered by mid-2005 to customers in the Czech Republic, New Zealand, South Africa, Sweden, Switzerland, United Kingdom and US.

COSTS: Approximately USD1,000,000 (2004).

DESIGN FEATURES: Based on Cresco, but optimised for utility market, especially sport parachuting. Design objectives included good visibility from cockpit, ease of handling and high crosswind limit (15 kt). Cargo pod certified in 2006.

Wing section NACA 4415 (constant); no dihedral on inner wing; 8° dihedral on outer wing panels; incidence 2°.

FLYING CONTROLS: Conventional and manual. Mass-balanced ailerons (travel +25/-10°), horn/mass-balanced elevator (+30/8 1/2°) and rudder; electric elevator trim with manual override; electric aileron trim (port); manual rudder trim; single-slotted flaps, deflection 21° for T-O, 40° for landing. Control surface actuation by cables; movements are ailerons +23°/-9° 30', elevators +10° 30'/-27° 30', rudder 20° port/25° starboard.

STRUCTURE: Conventional light alloy; single-spar wing; engine cowlings of Kevlar and glass fibre; composites wingroot glove. Cockpit area stressed for 25 g impact.

LANDING GEAR: Tricycle type; fixed. Wing-mounted cantilever main legs with oleo-pneumatic shock absorption. Cleveland wheels and hydraulic disc brakes on main units. Goodyear tyres, size 8.50-10 (10 ply) on mainwheels, pressure 2.76 Bar (40 lb/sq in). Nosewheel 8.5-6 (6 ply), pressure 2.07 Bar (30 lb/sq in), steerable 20° port/starboard. Minimum turning radius 12.27 m (40 ft 3 in).

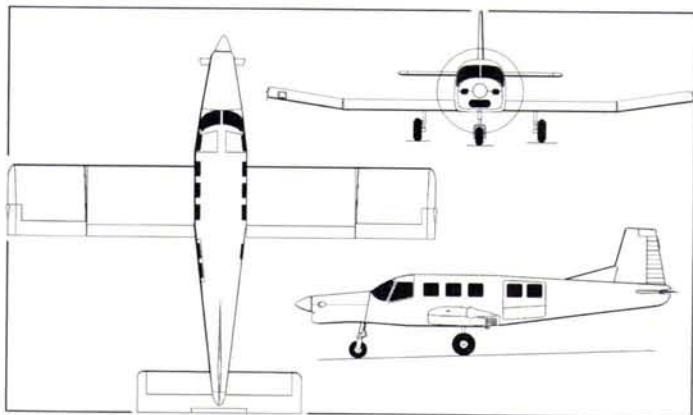
POWER PLANT: One 559 kW (750 shp) Pratt & Whitney Canada PT6A-34 turboprop. Hartzell HC-B3TN-3D/T10282NS+4 three-blade constant-speed, fully feathering, reversible-pitch metal propeller. Four integral fuel tanks in wing centre-section, total capacity 861 litres (227 US gallons; 189 Imp gallons), of which 841 litres (222 US gallons; 185 Imp gallons) usable. Individual gross capacities: 284 litres (75.0 US gallons; 62.5 Imp gallons) front left; 293 litres (77.3 US gallons; 64.5 Imp gallons) front right; 142 litres (37.5 US gallons; 31.2 Imp gallons) rear left and same in rear right. Oil capacity 8.7 litres (2.3 US gallons; 1.9 Imp gallons). Four refuelling points in upper surface of each wing.

ACCOMMODATION: Cabin carries nine seated passengers at 86 cm (34 in) pitch or 18 floor-sitting parachutists (plus single pilot) and has 16 floor-mounted tiedown points and seat rails; cabin door, on port side behind wing, either two (fore- and aft-hinged) freight doors or tambour door composed of multiple, transparent, hinged elements, which slides upwards on tracks and can be closed by remote control by pilot; two upward-hinged doors on each side of cockpit for crew entry. Dual controls, but starboard control column



Raeaford Parachute Center prepares to jump from a PAC 750XL

1040381



Pacific Aerospace Corporation 750XL general arrangement (Paul Jackson)

0552997

removable. Max floor loading 730 kg/m² (150 lb/sq ft). Medevac version can carry two stretchers and three seated passengers, plus two flight crew. Optional ventral baggage pannier.

SYSTEMS: 24 V DC electric system. Air conditioning optional.

AVIONICS: Comms: Garmin GMA 340 audio panel, GNC 250 com/nav and GTX 327 transponder.

Flight: Garmin GNS 430 GPS.

DIMENSIONS, EXTERNAL:

Wing span	12.81 m (42 ft 0 in)
Wing chord, constant	2.13 m (7 ft 0 in)
Wing aspect ratio	6.0
Length overall	11.84 m (38 ft 10 in)
Fuselage:	
Max width	1.52 m (5 ft 0 in)
Max height	1.57 m (5 ft 2 in)
Height overall	4.04 m (13 ft 3 in)
Tailplane span	4.95 m (16 ft 3 in)
Wheelbase	3.17 m (10 ft 5 in)
Wheel track	3.68 m (12 ft 1 in)
Min ground turning radius	9.18 m (30 ft 1½ in)
Propeller diameter	2.69 m (8 ft 10 in)
Propeller ground clearance	0.41 m (1 ft 4 in)
Cabin door (port): Height	1.19 m (3 ft 11 in) ¹

Width	1.27 m (4 ft 2 in)
Height to sill	1.12 m (3 ft 8 in)

¹ Slightly reduced by alternative door for parachuting

DIMENSIONS, INTERNAL:

Cabin: Length	4.01 m (13 ft 2 in)
Max width	1.37 m (4 ft 6 in)
Max height	1.42 m (4 ft 8 in)
Volume	6.37 m ³ (225 cu ft)

AREAS:

Wings, gross	28.34 m ² (305.0 sq ft)
Ailerons (total)	2.04 m ² (21.94 sq ft)
Trailing-edge flaps (total)	2.95 m ² (31.74 sq ft)
Fin	1.80 m ² (19.40 sq ft)
Rudder	1.08 m ² (11.70 sq ft)
Tailplane (excluding elevators)	3.13 m ² (33.64 sq ft)
Elevator, incl tab	2.59 m ² (27.92 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	1,406 kg (3,100 lb)
Max fuel weight	686 kg (1,512 lb)
Typical payload	1,996 kg (4,400 lb)
Max T-O weight	3,402 kg (7,500 lb)
Max landing weight	3,231 kg (7,125 lb)
Max wing loading	120.1 kg/m ² (24.59 lb/sq ft)
Power loading at Normal max T-O weight:	6.09 kg/kW (10.00 lb/shp)

PERFORMANCE:

Never-exceed speed (VNE):

cabin door closed	170 kt (314 km/h; 195 mph)
cabin door open	130 kt (240 km/h; 149 mph)
Max level speed at S/L	169 kt (313 km/h; 194 mph)
Stalling speed: flaps up	69 kt (128 km/h; 79 mph)
flaps down, power off:	
at 3,402 kg (7,500 lb)	58 kt (108 km/h; 67 mph)
at 1,814 kg (4,000 lb)	45 kt (84 km/h; 52 mph)
Max rate of climb at S/L	547 m (1,795 ft)/min
Time to FL120	12 min
Time to S/L from FL120	3 min
Absolute ceiling	6,095 m (20,000 ft)
T-O run	276 m (907 ft)
T-O to 15 m (50 ft)	331 m (1,085 ft)
Landing from 15 m (50 ft)	426 m (1,400 ft)
Landing run	100 m (330 ft)
Range at 75% power with standard fuel, 45 min reserves	582 n miles (1,077 km; 669 miles)
Endurance with standard fuel, no reserves	
at 75% power	5 h 0 min

SHEARWATER

SHEARWATER INDUSTRIES

c/o Po Box 5211, Christchurch 8021

Web: www.shearwaterindustries.com

DIRECTOR: Ray Hampton

MANAGING DIRECTOR: Steve Hoyle

PROJECT ENGINEER: Paul Schofield

Company formed October 2004 to promote and produce Shearwater amphibian.

SHEARWATER SHEARWATER

TYPE: Four-seat amphibian/kitbuilt.

PROGRAMME: Prototype (ZK-SFA), designed by Bill Townson and built by Seaflight (NZ) Ltd, first flew 28 September 2001; re-registered ZK-TNZ in May 2005; had flown some 30 hours by July 2005, when displayed at AirVenture, Oshkosh. First kits then due for delivery in second quarter of 2006. However, design considerably revised in late 2005 under aeronautical engineer Richard Roake, reducing drag and improving performance, delaying completion of first production aircraft to late 2006/early 2007.

CUSTOMERS: Four kits sold in New Zealand before international launch.

COSTS: Kit USD90,000 less engine and avionics (2006).

DESIGN FEATURES: Mid-wing amphibian with moderate wing leading-edge sweepback. Integral wingtip floats of prototype replaced by tip winglets, with narrow floats repositioned inboard at approx three-fifths of span. Prototype also had two-step hull with ducted steps for cleaner unstuck from water; air supplied from intake in mainwheel bays; this replaced by unstepped bottom incorporating forward-hinged, plank-shape hydroski which supports full MTOW at 18 knots (33 km/h; 21 mph). Dished upper fuselage with water drain hole, allowing lower thrust line for pusher propeller, which has 2.5 cm (1 in) fuselage clearance. Sweepback V tail. Leading-edge root extension to wing added after early trials. Kitbuilt to 51 per cent rule, but certifiable to FAR/EASA 23.

FLYING CONTROLS: Manual, Twin ruddervators, each with horn balance and flight-adjustable trim tab. Slotted flaps. Actuation by carbon fibre pushrods.

STRUCTURE: Composites throughout. Glass fibre hull, except carbon fibre upper section. Carbon fibre wing. Stainless steel metal fittings.

LANDING GEAR: Tricycle type; retractable. Electric actuation. Nosewheel retracts forward; mainwheels inward to underside of wing. Main tyres 6.00-6; nosewheel 5.00-5. Retractable water rudder behind second step. Simplified gear (omitting forward strut) to be introduced on production aircraft.



Prototype Shearwater amphibian on display at Oshkosh in July 2005 (Paul Jackson)

1129295

POWER PLANT: Prototype with one 157 kW (210 hp) Franklin flat-four, driving an MT-Propeller MT-18-D/LD-183-119 three-blade, variable-pitch pusher propeller. Production aircraft to have 190 kW (255 hp) Innodyn 255TE turboprop with five-blade propeller. Fuel in two wing tanks, combined capacity 104 litres (27.5 US gallons; 22.9 Imp gallons). Alternative power plants in 157 to 186 kW (210 to 250 hp) range. Optional ferry tanks in outer wings; max fuel capacity 520 litres (137 US gallons; 114 Imp gallons), although 455 litres (120 US gallons; 100 Imp gallons) for production version.

ACCOMMODATION: Four persons in two forward-facing pairs. Fixed windscreen, plus upward-hinged door each sides. Baggage compartment in nose accessed by external door atop fuselage.

DIMENSIONS, EXTERNAL:

Wing span	10.36 m (34 ft 0 in)
Wing aspect ratio	8.0
Length overall	7.87 m (25 ft 10 in)
Height overall	2.08 m (6 ft 10 in)
Propeller diameter	1.83 m (6 ft 0 in)

DIMENSIONS, INTERNAL:

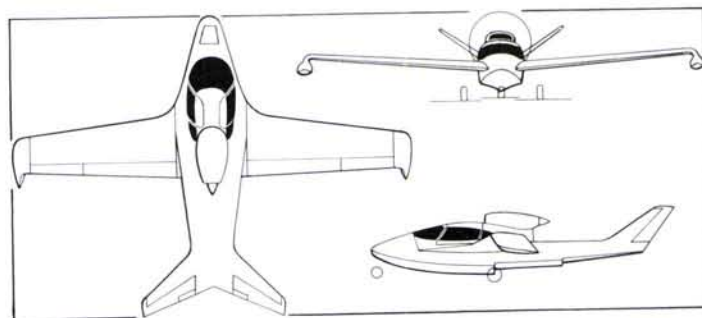
Cockpit: Length	2.39 m (7 ft 10 in)
Max width	1.35 m (4 ft 5 in)
Baggage compartment volume	1.0 m ³ (35 cu ft)

AREAS:

Wings, gross	13.38 m ² (144.0 sq ft)
Tail surfaces	2.42 m ² (26.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	825 kg (1,819 lb)
--------------	-------------------



Shearwater Shearwater general arrangement as originally envisaged (James Goulding)

1133728

Max T-O weight	1,500 kg (3,306 lb)
Max wing loading	112.1 kg/m ² (22.96 lb/sq ft)
Max power loading	7.89 kg/kW (12.96 lb/hp)
PERFORMANCE:	
Cruising speed	165 kt (306 km/h; 190 mph)
Stalling speed, flaps down	55 kt (102 km/h; 64 mph)

Pakistan

PAC

PAKISTAN AERONAUTICAL COMPLEX

Kamra, District Attock

WORKS: F-6 Rebuild Factory; Mirage Rebuild Factory; Kamra Avionics and Radar Factory;

Aircraft Manufacturing Factory (all at Kamra)

Tel: (+92 51) 909 90

Fax: (+92 51) 922 55 00

e-mail: sales@pac.org.pk

Web: www.pac.org.pk

MANAGEMENT BOARD:

Air Marshal Khalid Chaudhry (Chairman)

Air Cdre Javed Khan (Commercial)

Air Cdre Irfan ul Haq (Technical)

Badshah Gul (Finance)

MANAGING DIRECTORS:

Air Cdre Zakir Raja Hafeez (AMF)

Air Cdre Kamral Alam (F-6RF)

Air Cdre Ashfaq (MRF)

Air Cdre Sherzada Khan (KARF)

SALES AND MARKETING DIRECTOR: Arshad Majeed Khan

CHIEF TEST PILOT: Wg Cdr Ahmed Shujaa

Pakistan Aeronautical Complex (PAC) is the nucleus of the aeronautical industry in Pakistan. Its professional standards and reliability enable domestic customers and foreign agencies alike to undertake joint production with PAC in various fields. PAC Kamra comprises four factories: the Mirage Rebuild Factory (MRF), F-6 Rebuild Factory (F-6RF), Aircraft Manufacturing Factory (AMF) and Kamra Avionics and Radar Factory (KARF). All four are ISO 9000 certified.

Aircraft Manufacturing Factory (AMF): In operation since mid-1981, the AMF spearheads the aircraft manufacturing industry in Pakistan. It is the only aircraft manufacturing concern in Pakistan and is at present engaged in the manufacture of the Mushshak basic trainer-cum-surveillance aircraft; the Super Mushshak — a variant with a more powerful engine, cockpit air conditioning, electric instruments and several other improvements; the Baaz and Ababeel low-speed target drones for anti-aircraft gunnery training; and component manufacture for HAIC (Hongdu) of China of the K-8 (Karakoram) jet trainer aircraft, 12 of which already flying with the Pakistan Air Force. Manufacture of parts for Chengdu FC-1/JF-17 (eight of first 16 production aircraft) began in 2005. First Kamra-assembled JF-17 due for completion in 2006. In addition, the AMF has excellent facilities to rebuild and repair the Mushshak at factory level, along with after-sales spares support to existing Mushshak operators.

AMF also has the skills and capabilities of conventional/CNC machining, sheet metal forming, hand layout, contact suction hot press moulding, stretch moulding, gravity moulding, reaction injection moulding, mould/die and pattern making in woodwork, surface treatment/painting, heat treatment, tig welding (AC and DC), electric arc welding, gas welding, brazing, soldering, tube bending, material testing, spectroanalysis, tensile testing, precision measurement chemical analysis, CNS calibration, co-ordinate measurement, mould/dies and fixture designing in tooling facility, CNC copy milling and EDM (spark erosion) milling.

Kamra Avionics and Radar Factory (KARF): KARF, the fourth factory of PAC, came into operation in 1987. It is an electronics centre with proven capabilities for rebuilding of radars, control and reporting centres (CRC), generators, and manufacture and repair of avionics systems. Currently, it is producing ESM equipment and airborne radar systems. All production activities are carried out in large, spaciouly built shops equipped with state-of-the-art machinery. Apart from the production of BMJK/8602 RWR and Fiar Grifo 7 radar systems and the overhauling of pulse-Doppler radars, control and reporting centres and generators, KARF offers services in many fields such as surface mount technology, cable repair and manufacturing inspection/testing of microwave components, testing of gears and synchro bridge, environmental testing, testing hydraulic components, rebuilding of three-phase air conditioning systems and general engineering and painting facilities.

PAC (AMF) MUSHSHAK and SUPER MUSHSHAK

English name: Proficient

TYPE: Three-seat lightplane.

PROGRAMME: Fifteen Mushshaks supplied complete from Sweden; 10 then assembled from SKD kits and 82 from CKD kits at Risalpur between 1975 and 1981; completely indigenous production followed, with 180 delivered by December 1996; 113 repaired at Kamra including 100 from 1980 to 1996; engines, instruments, electrical equipment and radios

imported; complete airframe manufactured locally. Shahbaz (prototype 86-5147; first flight July 1987; English name Falcon) received US FAR Pt 23 certification 1989, but only four completed. Super Mushshak introduced 1997, entered production November 2000 and received domestic certification in 2002. Both versions still in production in 2006.

CURRENT VERSIONS: **Mushshak:** Standard production version; used for training, communications and observation; more than half a million hours flown by late 1999, AMF then upgrading first 16 (of 36) to Super Mushshak for PAF; 22 delivered by January 2003.

Super Mushshak: Further increase in power by adopting IO-540 flat-six engine. Prototype 95-5385X made first flight 15 August 1996. Revealed at Dubai Air Show in November 1997, at which time five completed. Pakistan Army has reportedly ordered 150, for delivery after completion of PAF order.

Description applies to above version, except where indicated.

CUSTOMERS: See table. Total of 327 accounted for, comprising 15 imported aircraft plus 285 Mushshaks, 24 Super Mushshaks and four Shahbaz acquired/produced by late 2004 (first upgraded Super Mushshak redelivered to Pakistan Air Force 16 May). First aircraft delivered to South Africa was 331st of type. Mushshak deliveries to Iran in 1988-91; six supplied to Syria and three to Oman in 1994. Last-named became first export customer for Super Mushshak in December 2001; these all handed over on 1 August 2002. Iranian Air Force reported to be considering upgrading its existing fleet to Supers. First civilian sale (apart from company demonstrator AP-PAC) to Uni Group Holdings of South Africa in 2004; type approved by SCAA on 24 January 2005; deliveries began May 2006.

MUSHSHAK PRODUCTION (at January 2005)

Customer	Quantity
At Risalpur	
Pakistan Air Force/Army	92 ¹
At Kamra:	
Pakistan Air Force	36 ²
Pakistan Army	117
Pakistan (Air Force and/or Army)	13
Iran (Air Force)	26 ³
Oman (Air Force)	8 ⁴
Saudi Arabia (Air Force)	20 ⁵
South Africa (civil)	5 ⁶
Syria (Air Force)	6
Pakistan Aeronautical Complex	4
Total	327⁸

¹ Saab kits (10 SKD, 82 CKD)

² First aircraft 83-5116 (numbers 5200-5299 not allocated); equip Nos. 1 and 2 Primary Flying Training Squadrons of PAF Academy and Headquarters Flights of Northern, Central and Southern Air Commands; being upgraded to Super in 2002-03

³ Plus complete aircraft from Saab to PAF and five Pakistani-built not accounted for

⁴ Includes five Super Mushshak; remaining three upgraded to Super and redelivered in 2003

⁵ Includes one Super Mushshak donated to Air Force Academy in 2002

⁶ Super Mushshak; order announced 31 May 2004; official handover 12 October 2004 (last two of first eight)

⁷ First aircraft (ZS-OKR) handed over 30 May 2006 to Falco Aviation and Leasing Company

DESIGN FEATURES: Based on Swedish Saab Safari/Supporter, but without latter's armament option. Optimised for military support (originally including light attack) from semi-prepared airstrips; wing position aids ground observation.

Wing thickness/chord ratio 10 per cent; dihedral 1° 30'; incidence 2° 48'; sweepforward 5° from roots.

FLYING CONTROLS: Manual, mass-balanced ailerons with servo tab in starboard unit; rudder with trim tab; all-moving mass-balanced tailplane with large anti-balance tab. Electrically actuated plain sealed flaps; leading-edge slots.

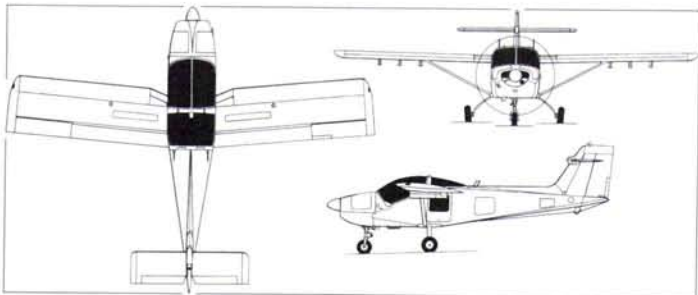
STRUCTURE: All-metal, except for GFRP tailcone, engine cowling panels, wing strut/landing gear attachment fairings and fin tip.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring composites cantilever main legs; Cessna oleo-pneumatic nosewheel shock strut. Goodyear wheels and Flight Custom tyres, size 6.00-6 (6 ply) on mainwheels and 5.00-5 (6 ply) on steerable (±30°) nosewheel. Tyre pressure (all units) 2.07 bar (30 lb/sq in). Parker Hannifin hydraulic disc brakes on main units.



First PAC Mushshak delivered to South Africa in 2006 (Patrick Allen)

1196398



PAC Mushshak (Dennis Punnett)

1121731

POWER PLANT: *Mushshak*: One 149 kW (200 hp) Textron Lycoming IO-360-A1B6 flat-four engine, driving a Hartzell HC-C2YK-4F/FC7666A-2 two-blade constant-speed metal propeller.

Super Mushshak: One 194 kW (260 hp) Textron Lycoming IO-540-V4A5 flat-six; Hartzell HC-C2YK-1BF two-blade constant-speed propeller.

Fuel (both versions) in two integral wing fuel tanks, total capacity 178 litres (47.0 US gallons; 39.1 Imp gallons), of which 159 litres (42.0 US gallons; 35.0 Imp gallons) are usable. Oil capacity (both) 7.5 litres (2.0 US gallons; 1.6 Imp gallons). From 10 to 20 seconds inverted flight (limited by oil system) permitted.

ACCOMMODATION: Side-by-side adjustable seats, with provision for back-type or seat-type parachutes, for two persons beneath fully transparent Upward-hinged canopy. Dual controls standard. Space aft of seats for 100 kg (220 lb) of baggage (with external access on port side) or, optionally, a rearward-facing third seat. Upward-hinged door, with window, beneath wing on port side. Cabin heated and ventilated in *Mushshak*, air conditioned in *Super Mushshak*.

SYSTEMS: Hydraulic reservoir for mainwheel brakes. 28 V DC electrical system (70 A alternator and 70 Ah battery).

AVIONICS: *Comms*: KT 76A/78A ATC transponder; KA 134 audio panel.

Flight: KX 125 nav/com; KLX 135 GPS/com; KR 87 ADF.

Instrumentation: Provision for full blind-flying instrumentation.

EQUIPMENT: Provision for six underwing attachment points, inner two stressed to carry up to 150 kg (330 lb) each and outer four up to 100 kg (220 lb) each. Options include ULV crop-spraying kit, target towing kit, or underwing supply/relief containers.

DIMENSIONS, EXTERNAL:

Wing span	8.85 m (29 ft 0½ in)
Wing chord: at root	1.21 m (3 ft 11¾ in)
outer panels, constant	1.36 m (4 ft 5½ in)
Wing aspect ratio	6.6
Length overall: <i>Mushshak</i>	7.00 m (22 ft 11½ in)
<i>Super Mushshak</i>	7.15 m (23 ft 5½ in)
Height overall	2.60 m (8 ft 6½ in)
Tailplane span	2.80 m (9 ft 2¼ in)
Wheel track	2.20 m (7 ft 2½ in)
Wheelbase: <i>Mushshak</i>	1.61 m (5 ft 3½ in)
<i>Super Mushshak</i>	1.58 m (5 ft 2¼ in)
Propeller diameter	1.93 m (6 ft 4 in)
Propeller ground clearance	7.62 cm (3 in)
Cabin door (port): Height	0.78 m (2 ft 6¾ in)
Width	0.52 m (1 ft 8½ in)

DIMENSIONS, INTERNAL:

Cabin: Max width	1.10 m (3 ft 7¼ in)
Max height (from seat cushion)	1.00 m (3 ft 3¼ in)

AREAS:

Wings, gross	11.90 m ² (128.1 sq ft)
Ailerons (total)	0.98 m ² (10.55 sq ft)
Flaps (total)	1.55 m ² (16.68 sq ft)
Fin	0.77 m ² (8.29 sq ft)
Rudder, incl tab	0.73 m ² (7.86 sq ft)
Tailplane, incl tab	2.10 m ² (22.60 sq ft)

WEIGHTS AND LOADINGS (*Mushshak* and *Super Mushshak*. A: Aerobatic, U: Utility, N: Normal category):

Weight empty, equipped: <i>Mushshak</i>	646 kg (1,424 lb)
<i>Super Mushshak</i>	760 kg (1,676 lb)
Max external stores load (both)	300 kg (661 lb)
Max T-O weight: A (both)	900 kg (1,984 lb)
U (<i>Mushshak</i>)	1,000 kg (2,205 lb)
U (<i>Super Mushshak</i>)	1,030 kg (2,270 lb)
N (<i>Mushshak</i>)	1,200 kg (2,645 lb)
N (<i>Super Mushshak</i>)	1,250 kg (2,755 lb)
Max wing loading: A (both)	75.6 kg/m ² (15.48 lb/sq ft)
U (<i>Mushshak</i>)	84.0 kg/m ² (17.20 lb/sq ft)
U (<i>Super Mushshak</i>)	86.6 kg/m ² (17.73 lb/sq ft)
N (<i>Mushshak</i>)	100.8 kg/m ² (20.65 lb/sq ft)
N (<i>Super Mushshak</i>)	105.0 kg/m ² (21.51 lb/sq ft)
Max power loading (<i>Mushshak</i>): A	6.04 kg/kW (9.92 lb/hp)
U	6.71 kg/kW (11.02 lb/hp)
N	8.05 kg/kW (13.23 lb/hp)
Max power loading (<i>Super Mushshak</i>): A	4.64 kg/kW (7.63 lb/hp)
U	5.31 kg/kW (8.73 lb/hp)
N	6.45 kg/kW (10.60 lb/hp)

PERFORMANCE (Utility category):

Never-exceed speed (VNE): both	196 kt (363 km/h; 226 mph)
Max level speed at S/L: <i>Mushshak</i>	130 kt (240 km/h; 149 mph)
<i>Super Mushshak</i>	145 kt (268 km/h; 166 mph)
Cruising speed at S/L at 75% power: <i>Mushshak</i>	115 kt (213 km/h; 132 mph)
<i>Super Mushshak</i>	130 kt (240 km/h; 149 mph)
Stalling speed, power off: <i>Mushshak</i> , flaps up	60 kt (111 km/h; 69 mph)
<i>Super Mushshak</i> , flaps up	57 kt (105 km/h; 66 mph)
<i>Mushshak</i> , flaps down	54 kt (100 km/h; 63 mph)
<i>Super Mushshak</i> , flaps down	52 kt (96 km/h; 60 mph)
Max rate of climb at S/L: <i>Mushshak</i>	372 m (1,220 ft)/min
<i>Super Mushshak</i>	518 m (1,700 ft)/min
Time to 1,830 m (6,000 ft): <i>Mushshak</i>	7 min 30 s
Time to 3,050 m (10,000 ft): <i>Super Mushshak</i>	10 min
Service ceiling: <i>Mushshak</i>	4,800 m (15,740 ft)
<i>Super Mushshak</i>	6,705 m (22,000 ft)
T-O run: <i>Mushshak</i>	150 m (495 ft)
<i>Super Mushshak</i>	183 m (600 ft)
T-O to 15 m (50 ft): <i>Mushshak</i>	252 m (825 ft)
<i>Super Mushshak</i>	275 m (900 ft)
Landing from 15 m (50 ft): <i>Mushshak</i>	314 m (1,030 ft)
<i>Super Mushshak</i>	296 m (970 ft)
Landing run: <i>Mushshak</i>	140 m (460 ft)
<i>Super Mushshak</i>	153 m (500 ft)
Range with max fuel: <i>Mushshak</i>	580 n miles (1,074 km; 667 miles)
<i>Super Mushshak</i>	440 n miles (814 km; 506 miles)
Max endurance at 65% power at S/L, 10% reserves:	
<i>Mushshak</i>	5 h 10 min
<i>Super Mushshak</i>	4 h 15 min
g limits (both): A	+6/-3
U	+5.4/-2.7
N	+4.8/-2.4

Poland

3XTRIM

ZAKŁADY LOTNICZE 3XTRIM SP. Z O.O. (3XTRIM AIRCRAFT FACTORY)

ulica Regeera 109, PL-43 382, Bielsko-Biała

Tel: (+48 33) 818 92 51

Fax: (+48 33) 818 91 21

e-mail: biuro@3xtrim.pl

Web: www.3xtrim.pl

PRESIDENT: Dariusz Pietraszkiewicz

CHIEF DESIGNER: Jerzy Mastek

WORKS

Bielsko-Biała and Szczecin; Warsaw factory planned

Company was formed in 1996 as WNKL Adam Kurbiel (former President, who died in July 2000), changing to its present title (signifying 'triple-trimmed') in November 1999, but has its roots in the SZD-PZL-Bielsko which for more than 40 years has been the major producer of Polish high-performance sailplanes and gliders. Factories at Bielsko-Biała and Szczecin have floor areas of 700 and 1,500 m² (7,535 and 16,145 sq ft) respectively; combined workforce 20 in January 2005. Its main current products are the two-seat lightplanes and ultralights described in this entry; other (non-aerospace) products in composites are also manufactured.

3XTRIM 450 ULTRA, 495 ULTRA PLUS and 550 TRENER

TYPE: Side-by-side ultralight; two-seat lightplane.

PROGRAMME: Development of EOL-2 Racek 2, of which some 20 built. Design started 1996, prototype 450-UL making maiden flight 15 May 1998; construction of first 3X55 Trener began 1997 (prototype SP-PUP made first flight 5 February 2000 and 150 hours flown by May 2001); static/fatigue testing October 1999 to January 2000; JAR-VLA tests completed 16 May 2000. Ultra has Czech ultralight certificate and Polish special certification; German (LFT-UL) certification of Ultra Plus under way February 2005, with completion of static and flight testing forecast for June 2005; one imported into Canada in 2006, seeking Canadian (AULA) approval.

Planned twin-float seaplane had not materialised by mid-2006.

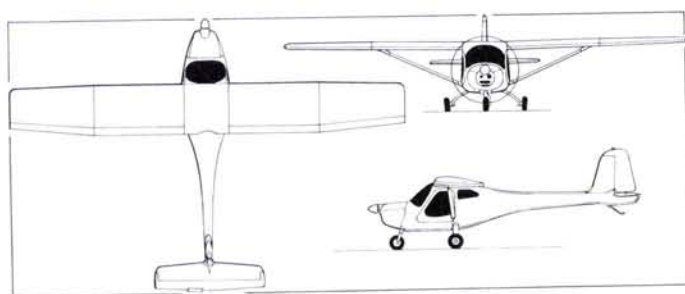
CURRENT VERSIONS: **450 Ultra:** Ultralight version, MTOW 450 kg (992 lb) achieved by wider use of CFRP instead of GFRP and omission of some equipment and furnishing (for example, no door stays).

495 Ultra Plus: German ultralight version; as Ultra but permissible MTOW increased to LFT-UL limit of 472.5 kg.



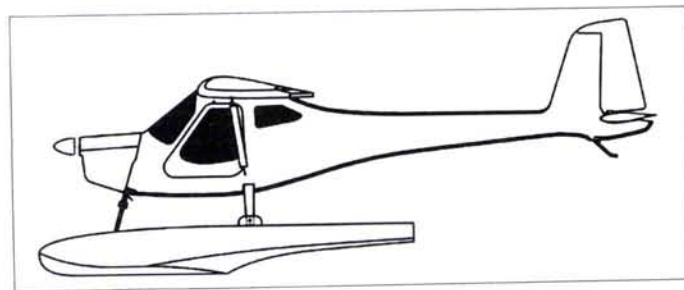
3Xtrim two-seat lightplane

1159206



3Xtrim 550 Trener two-seat lightplane (James Goulding)

0093619



Projected 3Xtrim floatplane

1121730

550 Trener: VLA version, for aero club and flying school (PPL) training; also available with aerial camera as border patrol and reconnaissance aircraft.

CUSTOMERS: Total 34 Ultras and 14 Treners ordered by December 2004. Customer countries include France. By mid-2006, 55 of all variants (including original Racek) built.

COSTS: Trener EUR44,000; Ultra EUR38,000; Ultra Plus EUR40,000; all excluding VAT (2005).

DESIGN FEATURES: Typical strut-braced high-wing cabin monoplane.

Wing section CAHI (TsAGI) R III (modified); dihedral 1° 30'; incidence 2° 30'; tailplane incidence -2° 30'.

FLYING CONTROLS: Conventional and manual (pushrod ailerons and elevator, cable-operated rudder). Elevator deflects 30° up/20° down; rudder 20° left/right. Rudder and one-piece elevator horn-balanced; Ultra has small, inset, electrically actuated trim tab in port half of elevator; tab in Trener is twice as large and protrudes beyond trailing-edge. Slotted flaps, deflection 33° up/15° down.

STRUCTURE: All-composites fuselage (glass and carbon fibre/epoxy cellular construction with plastics foam filling) with integral fin; GFRP sandwich single-spar wing.

LANDING GEAR: Tricycle type; fixed, GFRP, self-sprung fuselage-mounted cantilever mainwheel legs and rubber-sprung, castoring ($\pm 15^\circ$) 4.00-6 nosewheel. Mainwheels are size 5.00-5, with 350 x 135 tyres on Trener; size 4.00-8 on Ultra. Tyre pressure (all) 2.50 bar (36 lb/sq in); hydraulic disc brakes. Floatplane version planned.

POWER PLANT: *Ultra and Ultra Plus:* One 59.6 kW (79.9 hp) Rotax 912 A flat-four engine, driving a 3Xtrim 170 UL two-blade ground-adjustable pitch propeller.

Trener: One 73.5 kW (98.6 hp) Rotax 912 S flat-four; propeller as for Ultra/Ultra Plus.

Fuel capacity (all) 70 litres (18.5 US gallons; 15.4 Imp gallons) standard (65 litres; 17.2 US gallons; 14.3 Imp gallons usable), in single tank behind pilot's seat; optionally, two 43 litre (11.4 US gallon; 9.5 Imp gallon) tanks in same location. Oil capacity 2.5 litres (0.66 US gallon; 0.55 Imp gallon).

ACCOMMODATION: Two seats side by side; dual controls standard. Fully enclosed, heated and ventilated cabin with upward-opening door on each side. Baggage space behind seats.

SYSTEMS: Hydraulic system for brakes only; 12 V 18 Ah battery for electrical power.

AVIONICS: Bendix/King KY 97A or ICOM A-200 radios and Garmin GTX 327 transponder;

VFR instrumentation and stall warning system standard.

EQUIPMENT: BRS 5 ballistic recovery parachute.

DIMENSIONS, EXTERNAL (A: Ultra, B: Ultra Plus, C: Trener):

Wing span: A	9.60 m (31 ft 6 in)
B, C	10.03 m (32 ft 11 in)
Wing chord: at root (all)	1.30 m (4 ft 3¼ in)
at tip: A	1.00 m (3 ft 3¼ in)
Wing aspect ratio: A	7.8
B, C	8.1
Length overall (all)	6.87 m (22 ft 6½ in)
Fuselage max width (all)	1.18 m (3 ft 10½ in)
Height overall (all)	2.405 m (7 ft 10¼ in)
Tailplane span (all)	2.75 m (9 ft 0¼ in)
Wheel track (all)	1.895 m (6 ft 2½ in)
Wheelbase (all)	1.48 m (4 ft 10¼ in)
Propeller diameter (all)	1.70 m (5 ft 7 in)
Min propeller ground clearance (all)	0.195 m (7¼ in)
AREAS (A, B and C as above):	
Wings, gross: A	11.84 m ² (127.4 sq ft)
B, C	12.40 m ² (133.5 sq ft)
Ailerons (total)	1.00 m ² (10.76 sq ft)
Trailing-edge flaps (total)	1.38 m ² (14.85 sq ft)
Fin	0.44 m ² (4.74 sq ft)
Rudder	0.38 m ² (4.09 sq ft)
Tailplane	1.10 m ² (11.84 sq ft)
Elevator, incl tab	0.64 m ² (6.89 sq ft)

WEIGHTS AND LOADINGS (A, B and C as above):

Weight empty: (all)	285 kg (628 lb)
Max fuel weight (all)	49 kg (108 lb)
Max T-O weight: (all)	450 kg (992 lb)
Max wing loading: A	38.0 kg/m ² (7.78 lb/sq ft)
B, C	36.3 kg/m ² (7.43 lb/sq ft)
Max power loading: A, B	7.55 kg/kW (12.41 lb/hp)
C	6.12 kg/kW (10.06 lb/hp)

PERFORMANCE (A, B and C as above):

Never-exceed speed (VNE):	
A	108 kt (200 km/h; 124 mph) IAS
B, C	118 kt (220 km/h; 136 mph) IAS
Max cruising speed at 75% power (all)	94 kt (175 km/h; 109 mph) IAS
Stalling speed, 30° flap (all)	34 kt (63 km/h; 40 mph) IAS
Max rate of climb at S/L (all)	330 m (1,083 ft)/min
Service ceiling (all)	4,000 m (13,120 ft)
T-O run (all)	50 m (165 ft)
T-O to, and landing from, 15 m (50 ft): A, B	250 m (820 ft)
C	220 m (725 ft)
Range (all):	
standard fuel	405 n miles (750 km; 466 miles)
max optional fuel	675 n miles (1,250 km; 776 miles)
g limits (all)	+4.0/-2.0
OPERATIONAL NOISE LEVEL (ICAO Chapter 10, Appendix 16):	
Average	67 dBA

AERO

AERO SP. Z O. O.

Wał Miedzeszyński 844, PL-03-942 Warszawa
Tel: (+48 22) 616 20 87
Fax: (+48 22) 617 85 28
e-mail (1): aero@post.pl
e-mail (2): info@at-3.com
Web (1): www.aero.com.pl
Web (2): www.at-3.com
PRESIDENT: Ing Tomasz Antoniewski
CHIEF DESIGNER: Ing Marian Jakoniuk

FRENCH DISTRIBUTOR:
Thibaut Aero, Aéroport de Calais-Marck, F-62730 Marck
Tel: (+33 3) 21 46 51 31
Fax: (+33 3) 21 46 51 39
e-mail: rthibaut@nordnet.fr
Web: www.thibaut-aero.com

GERMAN DISTRIBUTOR:
S2T Aviation, Im Holderbett 31, D-73773 Aichwald
Tel: (+49 711) 365 02 52
Fax: (+49 711) 365 02 53
e-mail: info@s2taero.com

UK DISTRIBUTOR:
S2T Aviation, 125 High Road, North Weald, Essex CM16 6EA
Tel: (+44 1992) 52 27 97
Fax: (+44 1992) 61 07 25
e-mail: info@s2taero.com
Web: www.s2taero.com

Company formed in 1994. An Aerotechnik P.220 Koala kit was ordered that year, being given Polish designation suffix AT-2 (AT-1 having been a single-seat homebuilt design started in 1987). This was fitted with a 64.9 kW (87 hp) Limbach engine (first flight 12 December 1995 by SP-PUL, later SP-FUL). Experience gained in construction and use of AT-1 and AT-2 was utilised in design of the current AT-3.

AERO AT-3

TYPE: Side-by-side lightplane/kitbuilt.

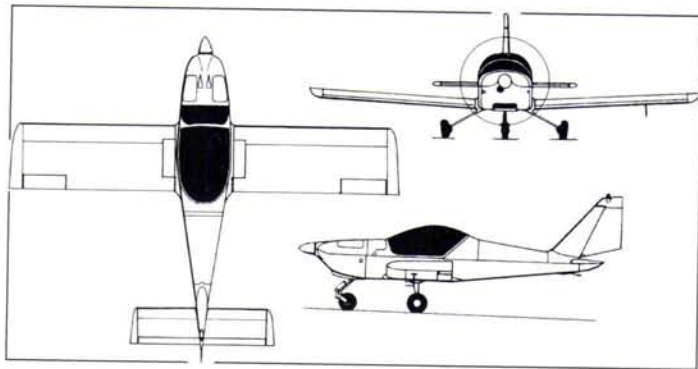
PROGRAMME: Completed initially (SP-PUH) as AT-3 with 67.1 kW (90 hp) Limbach L-2400EB3AC engine (basis for initial Type Certificate 14 May 1999) and re-registered SP-GUH; subsequently modified to AT-3 L100 with 74.6 kW (100 hp) Limbach L-2400DF1. Standard power plant then changed to Rotax 912S in 2001, and other modifications introduced; new designation AT-3 R100. This version became first aircraft to be awarded EASA community standard certification (CS-VLA category) in February 2005.

CURRENT VERSIONS: **AT-3 L100:** With 74.6 kW (100 hp) Limbach L-2400DF1 flat-four engine and MT-160L-120-2C propeller. Four built by 2003, all of which since converted to R100 version; none further expected.

AT-3 R100: With Rotax 912S flat-four. Otherwise as AT-3 L100. Standard version, as described.

AERO AT-3 PRODUCTION
(at April 2005)

c/n	Registration	Type	Remarks
001	SP-TPC	L100	To R100 by 2004; Warsaw Aeroclub
002	SP-TPD	L100	To R100 by 2004; Warsaw Aeroclub
003	SP-TPE	L100	To R100 2005
004	SP-TPF	L100	To R100 in 2005; French demonstrator F-GURT
005	SP-TPG	R100	Private owner: Poland
006/PFA327-14107	G-UKAT	AT-3SK	Kitbuilt; Trevor Archer (UK)
007	VH-	AT-	Kitbuilt; Australian owner
008	SP-EAR	R100	UK demonstrator G-SPAT
009	G-	AT-	Kitbuilt; UK customer
010	SP-KOS	R100	Private owner: Poland
011	G- SYWL	R100	Brooklands Flying Club, UK (delivery November 2005)
012	G- SWLL	R100	Brooklands Flying Club, UK (delivery November 2005)
013		R100	Kitbuilt; awaiting delivery mid-2006
014	EC-	R100	For Spain
015	EC-	R100	For Spain



Aero AT-3 R100 two-seat lightplane (Paul Jackson)

1121729

AT-3SK: Standard kit version.
AT-3AK: Advanced kit version.

CUSTOMERS: Initial customer Aeroclub of Warsaw; first two in service by May 2001. First kitbuilt (G-UKAT) completed April 2005. Two to Brooklands Flying Club, Sywell, UK; third on order. Refer to table.

COSTS: Flyaway: basic EUR81,450, club EUR92,000, tourer EUR100,840; kit from EUR29,800, excluding VAT (2006).

DESIGN FEATURES: Intended for basic training and low-cost touring; designed to absorb piloting errors or effects of landing on unprepared terrain. Low, constant-chord wing and tailplane; sweptback fin. Large rudder cutaway for elevator travel.

Wing section NACA 4415.

Changes from AT-2/P.220 S (retaining only a similar outward appearance) include approximately 1 m² (10.8 sq ft) more wing area; 10 cm (4 in) longer cockpit with revised geometry; enlarged (strengthened and thinner) fin and rudder; strengthened landing gear, wings, fuselage; extended wheel track and wheelbase.

FLYING CONTROLS: Manual; piano-type top-hinged ailerons, mass- and horn-balanced rudder and all-moving elevator with central trim tab; three-position split flaps (maximum deflection 40°).

STRUCTURE: Primarily metal, with some skins and fairings of Kevlar, carbon or glass fibre.

LANDING GEAR: Tricycle type; fixed. Cantilever, fuselage-mounted spring main legs with 380x150/15x6.00 wheels and hydraulic disc brakes; levered suspension nose leg with 5.00-4 wheel and rubber-in-compression shock absorption. Wheel fairings optional.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 S flat-four engine with GT-2/173/VRR-FW101SRTC two-blade, fixed-pitch or three-blade Elprop AS ground-adjustable, carbon composites aeroelastic propeller. Fuel capacity 70 litres (18.5 US gallons; 15.4 Imp gallons).

ACCOMMODATION: Two seats side by side; dual controls standard. Hatrack/baggage shelf behind seats, capacity 30 kg (66 lb). Upward-opening one-piece canopy, hinged at front.

AVIONICS: Bendix/King KY 97A transceiver and VFR instrumentation standard; optional equipment (customer choice) includes KT 76A transponder and directional gyro.

DIMENSIONS, EXTERNAL:

Wing span 7.55 m (24 ft 9 1/4 in)
Wing chord, constant 1.27 m (4 ft 2 in)
Wing aspect ratio 6.1



Aero AT-3 of Brooklands Flying Club

1159179

Length overall	5.88 m (19 ft 3½ in)
Height overall	2.23 m (7 ft 3¾ in)
Tailplane span	2.79 m (9 ft 1¾ in)
Wheel track	2.26 m (7 ft 5 in)
Wheelbase	1.36 m (4 ft 5½ in)
Propeller diameter	1.73 m (5 ft 8 in)
AREAS:	
Wings, gross	9.30 m² (100.1 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	350 kg (772 lb)
Max T-O weight	582 kg (1,283 lb)
Max wing loading	62.6 kg/m² (12.82 lb/sq ft)
Max power loading	7.92 kg/kW (13.01 lb/hp)

PERFORMANCE:	
Never-exceed speed (VNE)	120 kt (223 km/h; 138 mph) IAS
Max level speed	116 kt (215 km/h; 133 mph) IAS
Max cruising speed	108 kt (200 km/h; 124 mph) IAS
Max manoeuvring speed (VA)	106 kt (197 km/h; 122 mph) IAS
Stalling speed	44 kt (82 km/h; 51 mph) IAS
Max rate of climb at S/L	222 m (728 ft)/min
Service ceiling	3,800 m (12,460 ft)
T-O run	160 m (525 ft)
T-O to 15 m (50 ft)	440 m (1,445 ft)
Landing from 15 m (50 ft)	445 m (1,460 ft)
Landing run	150 m (495 ft)
Max range	488 n miles (904 km; 561 miles)
g limits	+3.8/-1.5

EADS PZL

EADS PZL WARSZAWA-OKECIE SA

aleja Krakowska 110/114, PL-00-971 Warszawa

Tel: (+48 22) 577 22 02

Fax: (+48 22) 577 22 03

e-mail: eads@pzl.eads.net

Web: www.pzl.eads.net

PRESIDENT AND CEO: José Leal Rocafull

VICE-PRESIDENT AND OPERATIONS DIRECTOR: Władysław Skorski

CHIEF MARKETING AND SALES EXECUTIVE: Zbigniew Wasiucionek

Oldest aircraft manufacturer in Poland, PZL Warszawa-Okecie SA was founded in 1928 and has subsequently built 71 different aircraft types, 48 of which went into series production. Currently occupies 279,373 m² (3,007,140 sq ft) site with 88,691 m² (954,660 sq ft) covered area; workforce approximately 500 in 2006. Responsible for light aircraft development and production, and for design and manufacture of associated agricultural equipment for its own aircraft and those built at other Polish factories; became public stock company, entirely owned by Ministry of Industry and Trade, on 2 January 1995; by 2006 had produced some 6,000 aircraft for customers in 30 countries. Manufacturer of the indigenous Wilga 2000 and Turbo Kruk continues.

On 16 October 2001, as part of the contract to supply eight C-295M transports to the Polish Air Force, EADS CASA (which see) acquired a 61 per cent holding in PZL Warszawa-Okecie. This subsequently increased to 76.4 per cent, with remainder being held by Polish Treasury Ministry (18.31 per cent) and company employees (5.29 per cent). Components for the CASA C-295 and CN-235 transports are being produced (first C-295 shipset delivered 22 May 2003), and integration of PZL into EADS has resulted in facilities being refurbished and modernised for new activities.

The company has been streamlined, and investments of up to EUR13 million and up-to-date technologies by the new owners have made it competitive with other European aviation product manufacturer. Aerostructures activity now consists chiefly of aluminium sheet component manufacture; subassembly of wings, ramp doors, portals, crew doors and electrical harnesses for the C-295 and CN-235 military transports; and cockpit section floor grids for the Airbus A320 family (first delivery 28 October 2004).

ZUA agricultural services division, which began operations more than 30 years ago, has a fleet of more than 100 M18 Dromaders, An-2s, PZL-106 Kruks and PZL-104 Wilgas, plus crews of experienced pilots and mechanics. These are able to offer services that include crop-spraying and dusting, firefighting, forestry inventories, environmental recovery, forest and pipeline patrol, advertising and charter flights, pilot and mechanic training, aircraft overhaul and technical maintenance.

EADS PZL has recently produced some 'follow-on' aircraft of types previously announced as having completed manufacture:

PZL-106BT Turbo-Kruk: One, SP-WTW c/n 1104269, produced 2005.

PZL-130TC-1 Orlik: Three additional aircraft built in 2004-05, becoming 050, 051 and 052 in Polish Air Force service.



PZL-130TC-1 Orlik 050, one of seven 'post production' aircraft known (Paul Jackson)

1159148

EADS PZL PZL-104M WILGA 2000

English name: Oriole

TYPE: Four-seat lightplane.

PROGRAMME: First flight of prototype Wilga 1, 24 April 1962, Polish certification of Wilga 80, 25 February 1980. This and all subsequent versions retroactively given EASA certification on 16 November 2005. Total of 962 of all earlier versions (except Indonesian licence-built Lipnur Gelatik) built by 1996, some of which stored and later supplied from stock, including one Wilga 80 in 1999.

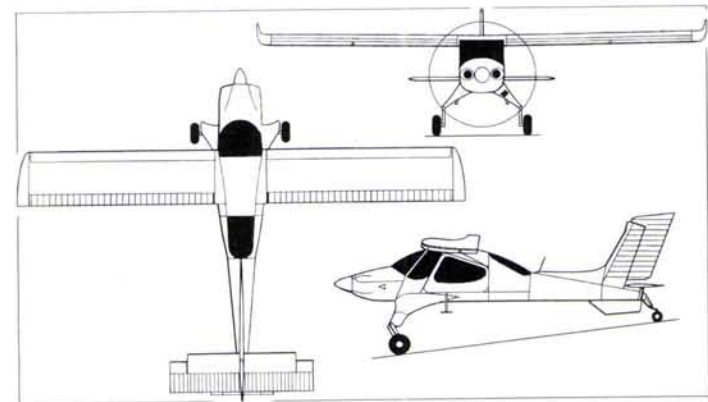
Wilga 2000, improved version of Wilga 35, developed to appeal to Western markets, principally through use of Western engine and avionics. Wing and nose modifications tested on Wilga 35A SP-CSG. First flight of Wilga 2000 prototype (SP-PHG, later -WHG) 20 August 1996; first production (SP-AHV) in mid-1997; SP-PHG won 1st World Air Games, 1997, FAR Pts 23/36 certification achieved 25 February 2002.

CURRENT VERSIONS: **PZL-104MA Wilga 2000:** Standard landplane version from 2005; as described. Continuing improvements include winglets; ventral strake; axisymmetric engine



EADS PZL-104MA Wilga 2000 handed over to Air Cadet League of Canada on 15 December 2005

1159181



PZL-104MA Wilga 2000 (216 kW; 290 hp IO-540 engine) (Paul Jackson)

1159136

cooling intakes; increases in cruising speed, payload and range; Garmin avionics. Polish GICA/CAIB certification 25 October 2005; EASA certification 16 November 2005.

PZL-104MF Wilga 2000: Polish Border Guard version. GICA/CAIB Polish certification 25 April 2001.

PZL-104MN Wilga 2000: Designation of nine aircraft built 2001 to 2004, Polish GICA/CAIB certification 8 March 2001; FAR Pt 23 certification 25 February 2002. From 2003, production aircraft had 1,500 kg (3,306 lb) MTOW and approximately 925 kg (2,039 lb) empty weight, reflecting improvements of 100 kg (220 lb) and 50 kg (110 lb), respectively.

PZL-104MW Wilga 2000 Hydro: Twin-float version; first flight 11 September 1999. MTOW of 1,500 kg (3,306 lb); performance generally similar to landplane except T-O run from water 180 m (590 ft) and S/L climb rate 210 m (689 ft)/min. Operated at continuous power rating of 216 kW (290 hp) at 2,575 rpm to decrease noise during T-O and climb. North American demonstrator under conversion in 2003 by Sealand Aviation of Vancouver, Canada; public debut in Anchorage, Alaska, May 2004. Canadian certification 2005. Sealand responsible for all aircraft of this configuration.

CUSTOMERS: First two deliveries in 1997 to Polish Aeroclub and private owner; five built in 1998 and delivered under 1997 contract to Polish Border Guard, first one being handed over 1 June 1998; one built in 1999, delivered to UK as demonstrator in May 2000. None built in 2000. At least five built in 2001; three in 2003 (including exports to Canada and US); one in 2004; two in 2005; and 21st aircraft (including prototype) in early 2006. Total of 25 sold by April 2006 to customers in Canada, Poland, Spain, UK and US; further 10 PZL-104MAS on order at that time.

DESIGN FEATURES: Suitable for wide variety of military, general aviation and flying club duties; STOL performance bestowed by flaps and slats allied to heavy-duty landing gear. High-mounted cantilever wings with upturned tips; braced tail unit with small underfin; tall landing gear legs. In addition to Western equipment, Wilga 2000 features increased fuel, strengthened wing with integral fuel tanks and mainwheel legs enclosed in fairings.

Wing section NACA 2415; dihedral 1°; incidence 8° 32'.

FLYING CONTROLS: Conventional and manual. Aerodynamically and mass-balanced slotted ailerons; tab on starboard aileron; aerodynamically, horn- and mass-balanced one-piece elevator and rudder; trim tab in centre of elevator; manually operated slotted flaps; fixed slot on wing leading-edge along full span. Aileron movement 26° up/16° down; elevator 38° up/18° down; elevator tab 20° up and down; rudder 26° left/right; flaps 0° up/21° down/44° down.

STRUCTURE: All-metal, with beaded skins; single-spar wings, with leading-edge torsion box; fuselage in two portions, forward incorporating main wing spar carry-through structure; rear section is tailcone; GFRP cabin floor covered with foam rubber; aluminium tailplane bracing strut.

LANDING GEAR: Tailwheel type; fixed. Semi-cantilever main legs, of rocker type, have faired-in side Vs attached to lower fuselage and oleo-pneumatic shock-absorbers. Cleveland and Goodyear wheels and hydraulic brakes standard on all versions from 2005. Low-pressure tyres; mainwheels 8.00-6; tailwheel 255X110, steerable, carried on rocker frame with oleo-pneumatic shock-absorber. Can be equipped with floats, skis or tundra tyres.

POWER PLANT: One 216 kW (290 hp) Textron Lycoming IO-540-K1B5 or -K1D5 flat-six engine, driving a Hartzell HC-E3YR-1RF/F8068+2 three-blade constant-speed propeller. Fuel in integral wing tanks, total capacity 400 litres (106 US gallons; 88.0 Imp gallons), of which 380 litres (100.4 US gallons; 83.6 Imp gallons) are usable. Oil capacity 11.4 litres (3.0 US gallons; 2.5 Imp gallons).

ACCOMMODATION: Passenger version accommodates pilot and three passengers, in pairs, with adjustable front seats. Baggage compartment aft of seats, capacity 30 kg (66 lb). Rear seats can be replaced by additional fuel tank for longer-range operation. Upward-opening door on each side of cabin, jettisonable in emergency. Braces-type shoulder harnesses, attached to fuselage upper frames, optional.

AVIONICS: Comms: Garmin GNS-430 nav/com/GPS or GNC-250XL alternative.

Instrumentation: ASI, VSI, ADF, VOR and twin indicators; artificial horizon; directional gyro; magnetic compass; altimeter; stall warning device; signalling and warning panel; clock; rpm tachometer; standard fuel/pressure/temperature gauges and indicators.

Mission: Ability to carry FLIR system.

EQUIPMENT: Heavy-duty glider-towing hook and release mirrors available as option.

DIMENSIONS, EXTERNAL:

Wing span	11.28 m (37 ft 0 in)
Wing chord, constant	1.40 m (4 ft 7 in)
Wing aspect ratio	8.2
Length overall	8.62 m (28 ft 3½ in)
Height overall	2.58 m (8 ft 5½ in)
Tailplane span	3.70 m (12 ft 1¾ in)
Wheel track	2.81 m (9 ft 2½ in)
Wheelbase	6.39 m (20 ft 11½ in)
Propeller diameter	2.13 m (7 ft 0 in)

Passenger doors (each): Height	0.90 m (2 ft 11½ in)
Width	1.50 m (4 ft 11 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	2.20 m (7 ft 2½ in)
Max width	1.20 m (3 ft 10 in)
Max height	1.50 m (4 ft 11 in)
Floor area	2.20 m² (23.8 sq ft)
Volume	2.40 m³ (85 cu ft)
Baggage compartment	0.50 m³ (17.5 cu ft)
AREAS:	
Wings, gross	15.50 m² (166.8 sq ft)
Tailplane	3.16 m² (34.01 sq ft)
Elevator, incl tab	1.92 m² (20.67 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	968 kg (2,134 lb)
Max baggage weight	30 kg (66 lb)
Max T-O and landing weight	1,500 kg (3,306 lb)
Max zero-fuel weight	1,427 kg (3,146 lb)
Max wing loading, option	96.8 kg/m² (19.82 lb/sq ft)
Max power loading, option	6.71 kg/kW (11.02 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	131 kt (243 km/h; 151 mph) IAS
Cruising speed at 75% power	113 kt (211 km/h; 131 mph) IAS
Stalling speed: flaps up	54 kt (100 km/h; 63 mph) IAS
flaps down	51 kt (93 km/h; 58 mph) IAS
Max rate of climb at S/L	243 m (797 ft)/min
Service ceiling	3,540 m (11,610 ft)
T-O run	206 m (675 ft)
Landing run	97 m (320 ft)
Max range	755 n miles (1,400 km; 869 miles)

EKOLOT

EKOLOT

ulica Pużaka 18, PL-38 400 Krosno
 Tel/Fax: (+48 13) 436 88 97
 e-mail: henryk@ekolot.pl
 Web: www.ekolot.pl
 DIRECTOR: Henryk Słowik
 DESIGNER: Jerzy Krawczyk

Ekolot's current product range includes the JK-01A Elf, JK-02 Fafik sailplane and JK-05 Junior ultralight. No progress with the JK-04 RS Albatros had been reported by mid-2005, and this aircraft no longer being promoted by mid-2006.

EKOLOT JK-01A ELF

TYPE: Single-seat ultralight motor glider/kitbuilt.

PROGRAMME: Designed by Jerzy Krawczyk; initial JK-01 flown in mid-1990s with 9.00 m (29 ft 6¼ in) span and 9.00 m² (96.9 sq ft) wing area.

Revised JK-01a developed to specifications of XC Aviation (www.xcaviation.com) of Glasgow, UK. Prototype registered (in France) as W64-MA and made public debut, complete but not then flown, at International Microlight Exhibition, Popham, UK, on 29-30 April 2006.

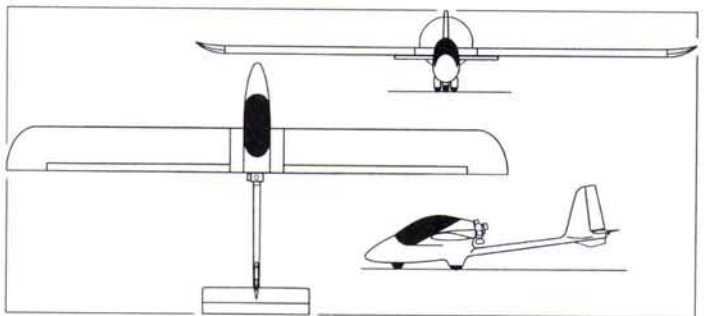
COSTS: Kit GBP10,990 excluding engine; or GBP13,750 all carbon fibre. Flyaway GBP3,660 extra. Engine GBP1,725. Instruments not included (2006).

DESIGN FEATURES: Combination of cross-country ultralight and thermal- or ridge-soaring sailplane; intended to incorporate high technology at low cost and meet British BCAR Section S criteria. Uses some components of Ekolot JK-05. Constant-chord wings with upturned tips mounted in mid-position immediately behind pilot; narrow tailboom; low-mounted, single-piece elevator to rear of rudder; underfin.

Aerofoil section MM18-17 to give mild, stable stall, unaffected by rain or insect adhesion.



Prototype Ekolot JK-01a Elf at its unveiling at Popham, UK, on 29 April 2006 (Paul Jackson)



Ekolot JK-01a Elf single-seat motor glider/tourer (Paul Jackson)

0581613

FLYING CONTROLS: Manual. Flaperons, single-piece elevator and full-height rudder. Actuation by cable (rudder only) and pushrods.

STRUCTURE: Generally of Parabeam glass fibre, plus carbon fibre for main spar, cockpit roving and tailboom. Optionally, all carbon fibre.

LANDING GEAR: Tricycle type; fixed. Twin mainwheels mounted at fuselage hips to give narrow track; no shock absorption.

POWER PLANT: One 14.9 kW (20 hp) JPX D330 flat-twin, two-stroke piston engine driving a Peszke three-blade folding propeller via toothed belt. Fuel capacity 15 litres (4.0 US gallons; 3.3 Imp gallons).

EQUIPMENT: Optional Alpharaparchute ballistic recovery parachute.

DIMENSIONS, EXTERNAL:

Wing span	11.12 m (36 ft 5¼ in)
Length overall	5.65 m (18 ft 6½ in)
Height overall	1.92 m (6 ft 3½ in)
Wheel track	0.30 m (1 ft 0 in)

AREAS:	
Wings, gross	10.80 m ² (116.3 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty: carbon fibre	80 kg (176 lb)
composites	145 kg (320 lb)
Max T-O weight	250 kg (551 lb)
PERFORMANCE, POWERED:	
Never-exceed speed (VNE)	81 kt (150 km/h; 93 mph)
Normal cruising speed	59 kt (110 km/h; 68 mph)
Max rate of climb at S/L	66 m (216 ft)/min
g limits (ultimate)	+6/-3
PERFORMANCE, UNPOWERED:	
Best glide ratio	24
Min rate of sink	1.10 m (3.60 ft)/s

EKOLOT JK-05 JUNIOR

Canadian marketing name: Pathmaker

Spanish marketing name: Ecoflyer

TYPE: Side-by-side ultralight.

PROGRAMME: Design revealed publicly March 1997; composites airframe of JK-03 Junior (also known as Beetle) prototype completed mid-1998; this aircraft made maiden flight 9 November 1999, powered by Suzuki motorcar engine. Public debut mid-2000 at air show in Blois, France, resulting in French orders for four production JK-03s. Improved version then developed as JK-05, making first flight 30 August 2001, powered by Rotax 582 UL engine. Verner 133 M and Rotax 912 UL introduced as alternative power plants in May and October 2002 respectively.

Changes from JK-03 include increased MTOW; higher g limits; max flaperon deflection reduced; nosewheel steering via rudder pedals; longer-stroke landing gear legs; and modified window/door opening.

CURRENT VERSIONS: **JK-03 Junior:** Prototype and first four production aircraft.

JK-05L Junior/Beetle: Current production version; *as described*.

Pathmaker: Rotax 912 UL engine and 65 litres (17.2 US gallons; 14.3 Imp gallons) fuel; max T-O weight 560 kg (1,234 lb); max range 410 n miles (760 km; 472 miles).

CUSTOMERS: Total 43 of Junior/Beetle series built by April 2006, including exports to Canada, France, South Africa, Thailand and US.

COSTS: EUR27,500 plus tax (2003).

DESIGN FEATURES: Braced high-wing monoplane (single I strut each side) with sweptback vertical tail; constant chord, non-swept wings (with leading-edge cutout at root to improve cockpit view) and horizontal tail. Small underfin.

Laminar flow wing section (modified NN 1817).

FLYING CONTROLS: Manual (pushrods and cables). Electrically actuated full-span slotted flaperons (6° up, 15 and 28° down); one-piece elevator, with electrically actuated central trim tab.

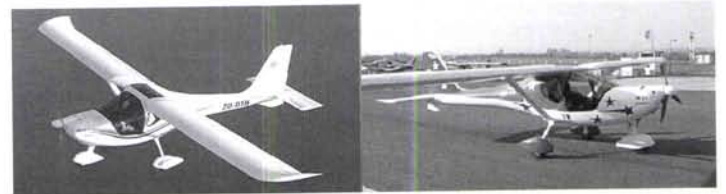
STRUCTURE: Stainless steel tube main frame; remainder of GFRP/CFRP-reinforced resin composites. Foam and carbon fibre wing main spar. Fin integral with fuselage. Can be assembled/disassembled for storage and transportation by two people in about 10 minutes.

LANDING GEAR: Tricycle type; fixed. Cantilever, fuselage-mounted, self-sprung composites main gear legs; steel nosewheel strut with rubber-in-compression shock-absorbers. All three wheels size 350x150 and fitted with speed fairings. Mainwheels have Bowden cable brakes; nosewheel steerable by rudder pedals.

POWER PLANT: One 47.8 kW (64.1 hp) Rotax 582 UL or 58.2 kW (78 hp) Verner 133 M flat twin, or 59.6 kW (79.9 hp) Rotax 912 UL flat-four; Aero Sail three-blade propeller.

Two fuel tanks aft of cockpit, combined capacity 60 litres (15.9 US gallons; 13.2 Imp gallons); gravity filler cap aft of wing on port side.

ACCOMMODATION: Window/door each side, hinged on centreline and opening upward; additional transparencies aft of these and in cabin roof. Baggage space aft of seats.



Views of EKOLOT JK-05 Beetle/Junior

1159215

AVIONICS: Standard VFR instrumentation and flap position indicator. Options include intercom and ICOM IC-A110 radio.

EQUIPMENT: Galaxy recovery parachute in fuselage top-decking.

DIMENSIONS, EXTERNAL:

Wing span	10.56 m (34 ft 7¾ in)
Length overall	5.95 m (19 ft 6¼ in)
Height overall	2.30 m (7 ft 6½ in)

DIMENSIONS, INTERNAL:

Cabin max width	1.20 m (3 ft 11¼ in)
-----------------	----------------------

AREAS:

Wings, gross	11.00 m ² (118.4 sq ft)
--------------	------------------------------------

WEIGHTS AND LOADINGS (A: Rotax 582, B: Rotax 912, C: Verner 133 M):

Weight empty: A	265 kg (584 lb)
B	280 kg (617 lb)
C	290 kg (639 lb)

Max T-O weight: except Pathmaker 480 kg (1,058 lb)

Max wing loading: except Pathmaker 43.64 kg/m² (8.94 lb/sq ft)

Max power loading: A 10.04 kg/kW (16.50 lb/hp)

B 8.05 kg/kW (13.23 lb/hp)

C 8.25 kg/kW (13.55 lb/hp)

PERFORMANCE, POWERED (A, B and C as above):

Never-exceed speed (VNE):

all 113 kt (210 km/h; 130 mph)

Max level speed: A 97 kt (180 km/h; 112 mph)

B 113 kt (210 km/h; 130 mph)

C 103 kt (190 km/h; 118 mph)

Max cruising speed, 75% power:

A 84 kt (155 km/h; 96 mph)

B 97 kt (180 km/h; 112 mph)

C 89 kt (165 km/h; 103 mph)

Stalling speed, flaperons down:

all 31 kt (56 km/h; 35 mph)

Max rate of climb at S/L: A 240 m (787 ft)/min

B 480 m (1,575 ft)/min

C 300 m (984 ft)/min

T-O run: A, C 120 m (395 ft)

B 80 m (265 ft)

T-O to 15 m (50 ft): A, C 220 m (720 ft)

B 150 m (495 ft)

Landing run: all 100 m (330 ft)

Max range: A 243 n miles (450 km; 279 miles)

B 378 n miles (700 km; 435 miles)

C 270 n miles (500 km; 310 miles)

g limits +5/-3

PERFORMANCE, UNPOWERED:

Best glide ratio: power off 13-14

engine idling 9-10

J & AS

J & AS AERODESIGN

Ulica Nowowiejska 2/29, PL-91-061 Łódź

Tel/Fax: (+48 42) 32 35 52

e-mail: xwojtasx@wspiz.edu.pl

Web: www.fregata.terramail.pl

CHAIRMAN: Jan Borowski

CHIEF DESIGNER: Jaroslaw Janowski

Jaroslaw Janowski designs began with J1 Przablanczka kitbuilt first flown 30 July 1970; subsequently included similar, but T-tailed, J2 Polonez and J3 Orzel (Eagle); and V-tailed J5 Marco, of which last-named described under Aviation Farm heading in 2000-01 *All the World's Aircraft*. Fregata is essentially a larger and higher-powered version of J5, developed in early 1990s; sales quiescent for several years, but four sold to UK in 2005 and prospect of further six to same customer by end of 2006.

J & AS J6 FREGATA

English name: Frigate Bird

TYPE: Single-seat ultralight/motor glider.

PROGRAMME: Prototype SP-P046 (later SP-0046), piloted by Jerzy Kedzierski, first flew December 1993 with a 29.1 kW (39 hp) Mosler CB-40 engine, and with a 38.8 kW (52 hp) modified Honda BF45 three-cylinder jet-ski engine on 19 July 1995. This lost in accident 16 July 1996, by which time second prototype (SP-P049) had been built with conventional

(two mainwheels) landing gear. Completion of c/n 003 and 004 implied by reservation in July 2000 of US registration N105JJ for c/n 005 (taken up 2 March 2004). Planned JAR 22 certification apparently not obtained; aircraft is registered in Experimental category.

No further news until early 2006, when disclosed that BAE Systems in UK had purchased 'principal components' of four aircraft in 2005 for use in its development of HERTI (High Endurance Rapid Technology Insertion) long-range reconnaissance UAV. At that time, BAE planned to acquire kits for a further six Fregatas by end of 2006. One J6 registered in Canada in April 2006.

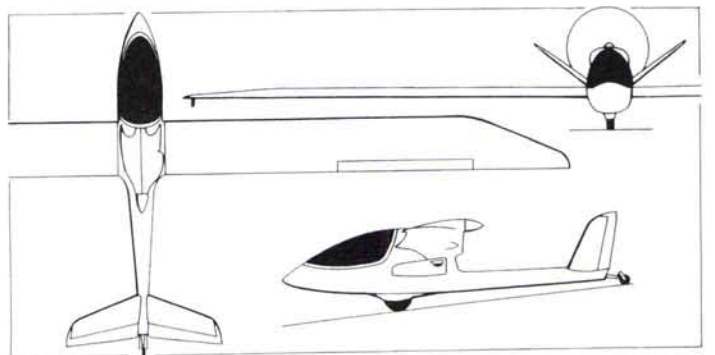
DESIGN FEATURES: Constant-chord, mid-mounted wings with tapered tips. Pod-and-boom fuselage; pusher engine; V tail.

Wortmann FX-67K-170-17 aerofoil section and 1° 30' dihedral.

FLYING CONTROLS: Manual. Twin ruddervators and conventional ailerons. Schempp-Hirth type airbrakes in upper surface of wing.

STRUCTURE: GFRP/epoxy; single-spar wings.

LANDING GEAR: Fixed. Motor glider has single mainwheel, plus tailwheel, and outrigger wheels slightly inboard of wingtips; tyre sizes 350x135 (main), 120x30 (tailwheel). Ultralight has two cantilever sprung mainwheels, plus tailwheel.



Motor glider version of J6 Fregata (Paul Jackson)

1159135



J6 Fregata single-seat motor glider (R J Malachowski)

0051153

POWER PLANT: One 38.8 kW (52 hp) J & AS 3PZ-800 (Honda BF45A) three-cylinder, liquid-cooled, geared, four-stroke in-line engine; J & AS two-blade fixed-pitch wooden pusher propeller.

First pair for BAE systems fitted with modified BMW motorcar engine; second pair have turbocharged Rotax 914 F.

Fuel capacity 60 litres (15.8 US gallons; 13.2 Imp gallons). Oil capacity 2.5 litres (0.7 US gallon; 0.6 Imp gallon).

DIMENSIONS, EXTERNAL:

Wing span	12.55 m (41 ft 2 in)
Wing aspect ratio	17.2
Length overall	5.11 m (16 ft 9 1/4 in)
Height overall	1.58 m (5 ft 2 1/4 in)
Propeller diameter	1.25 m (4 ft 1 1/4 in)

AREAS:

Wings, gross	9,135 m ² (98.3 sq ft)
--------------	-----------------------------------

WEIGHTS AND LOADINGS:

Weight empty	245 kg (540 lb)
Max T-O weight	410 kg (903 lb)
Max wing loading	44.9 kg/m ² (9.19 lb/sq ft)
Max power loading	10.57 kg/kW (17.36 lb/hp)

PERFORMANCE, POWERED:

Never-exceed speed (VNE)	135 kt (250 km/h; 155 mph)
Max level speed	103 kt (191 km/h; 118 mph)



Fregata modified by BAE Systems as HERTI-1A reconnaissance UAV (BAE)
1159201

Max cruising speed at 75% power	97 kt (180 km/h; 112 mph)
Stalling speed	38 kt (70 km/h; 44 mph)
Max rate of climb at S/L	396 m (1,299 ft)/min
Service ceiling	7,000 m (22,960 ft)
T-O run	120 m (395 ft)
Landing run	140 m (460 ft)
Range	540 n miles (1,000 km; 621 miles)
g limits	+5.3/-2.65

PERFORMANCE, UNPOWERED:

Best glide ratio, depending on propeller fitted	19-23
Min rate of sink	1.20 m (3.94 ft)/s

MMZL

**MARGANSKI & MYSLOWSKI ZAKLADY LOTNICZE SP. Z O.O.
(MARGANSKI AND MYSLOWSKI AVIATION EQUIPMENT
COMPANY)**

ulica Strazacka 60, PL-43 382 Bielsko-Biala

Tel/Fax: (+48 33) 815 01 10

e-mail: e.marganski@pro.onet.pl

Web: www.marganski.com.pl

MANAGING DIRECTOR: Edward Margański

Edward Margański has been connected with the design of several Polish light aircraft. His latest designs are the EM-10 Bielik, envisaged as a modern successor to the TS-11 Iskra jet trainer, and EM-11 Orka twin-engined utility aircraft.

Company established October 1986 as first aeronautical private enterprise in Poland, initially inspecting and repairing wooden gliders and later extending capabilities to overhaul and repair of motor gliders and all-composites sailplanes. Co-operated with Krakow Aviation Museum in reconstructing four historical aircraft, followed by Grunau Baby reconstruction for a Swedish customer. Designed, built and flew Swift S-1 and MDM-1 Fox sailplanes under contract to those companies during 1990s, eventually producing more than 30 of each type and modifying latter as motor glider. Bielik programme started 1999 and Orka two years later. Present name adopted in 2005 after acquisition of majority shareholding in Marbet company.

Non-aviation work has included composites components for motorcar bodies and, for Euros GmbH of Germany, 44 m (144.4 ft) diameter rotor blades for wind energy converters (WECs). In 2002, for customer in Belarus, designed and built components for a 1 MW WEC station said to be world's first to be based on the Magnus (rotating cylinder) effect. The factory has a floor area of 1,400 m² (15,070 sq ft) and a workforce (December 2004) of 34.

MMZL EM-10 BIELIK and FENIX

TYPE: Basic jet trainer.

PROGRAMME: Started as private venture under project name Iskra II, but renamed Bielik (a native Polish eagle) after press competition before public debut third quarter 2001 at exhibitions in Katowice and Radom. First flight (prototype SP-YEM) was then anticipated before end of 2001, but delayed by engine installation problems. Transported to Mielec for pre-flight preparation and tests in November 2002; first flight deferred until end of Polish winter: achieved 4 June 2003. Gradual development continuing, but at slow pace, with priority currently being given to Orka programme.

CURRENT VERSIONS: **Bielik:** Military basic and advanced training version, aimed at Polish and foreign air forces as low weight and cost pilot trainer.

Fenix: (English name Phoenix) Civil general aviation version, including aerobatics; intended for export.

DESIGN FEATURES: Low T-O weight achieved by rejection of onboard armament in favour of electronic combat application simulation system. Mid-wing, blended wing/body design with forward-extending curved strakes; twin outward-canted fins and rudders. Designed for high-g and high-AoA manoeuvres.

Supercritical wing and tailplane aerofoil section, thickness/chord ratio 6 per cent; wing anhedral 3° 30'; tailplane anhedral 10°.

FLYING CONTROLS: Manual, with hydraulically boosted all-moving slab tailplane, with electrically actuated tabs, for pitch and roll control; twin rudders deflect outwards only. Full-span leading- and trailing-edge flaps.

STRUCTURE: All-composites (carbon fibre and epoxy resin) stressed-skin sandwich over most of airframe. Single-spar wing.

LANDING GEAR: Hydraulically retractable tricycle type, with single wheel on each unit. Wheel sizes: main 49.5 cm (19 1/2 in), nose 15.2 cm (6 in). Mainwheels retract rearward, nosewheel forward. Mainwheel disc brakes.

POWER PLANT: One 12.75 to 17.65 kN (2,866 to 3,968 lb st) class turbojet in production aircraft; prototype has 13.52 kN (3,040 lb st) General Electric CJ610-6. Thrust vector control planned for production aircraft. Two fuel tanks in tandem in centre-fuselage, combined capacity 1,100 litres (291 US gallons; 242 Imp gallons).

ACCOMMODATION: Crew of two in tandem, on zero/zero ejection seats (zero height/150 kt; 278 km/h; 173 mph in prototype), in pressurised cockpit.

SYSTEMS: Hydraulic system, pressure 140 bar (2,030 lb/sq in), for landing gear, flap, airbrake and wheel brake actuation and slab tailplane control booster. Pneumatic system for emergency operation of trailing-edge flaps, landing gear extension and mainwheel brakes. 28 V DC electrical system. Crew oxygen system. Cockpit pressurisation system.

AVIONICS: Bielik basic trainer and Fenix to have standard nav/com avionics. Bielik advanced trainer version planned to be equipped with combat application electronic simulations of armament operation; real or virtual, radar- and IR-based observation and sighting systems; evaluation of sighting and weapon delivery techniques; and hostile air defence facilities.

DIMENSIONS, EXTERNAL:

Wing span	6.60 m (21 ft 7 3/4 in)
Wing aspect ratio	3.7
Length overall	9.00 m (29 ft 6 1/4 in)
Height overall	2.50 m (8 ft 2 1/2 in)

AREAS:

Wings, gross	11.90 m ² (128.1 sq ft)
--------------	------------------------------------



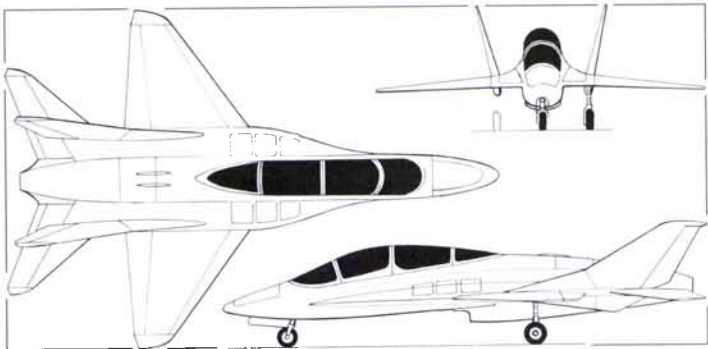
Bielik cockpit detail (Paul Jackson)

0552867



EM-10 Bielik tandem-seat jet (Paul Jackson)

0580829



EM-10 Bielik twin-tailed, tandem-seat jet trainer (James Goulding) 0143736

WEIGHTS AND LOADINGS:

Weight empty	1,700 kg (3,748 lb)
Fuel weight	850 kg (1,874 lb)
Max T-O weight	2,500 kg (5,511 lb)
Max wing loading	210.1 kg/m ² (43.03 lb/sq ft)
Max power loading (prototype)	185 kg/kN (1.81 lb/lb st)

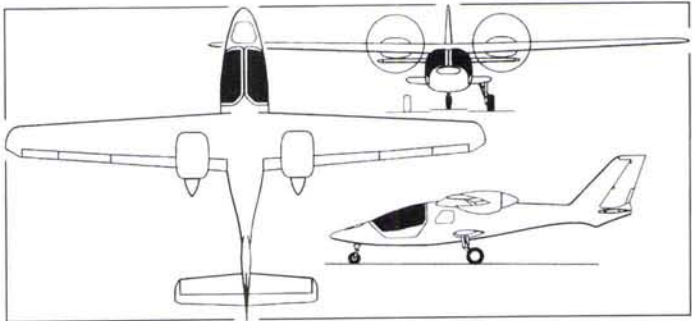
PERFORMANCE (estimated):

Max Mach No.	0.9
Max level speed	594 kt (1,100 km/h; 684 mph)
Stalling speed	90 kt (165 km/h; 103 mph)
Max rate of climb at S/L	2,700 m (8,858 ft)/min
Ferry range with auxiliary tanks	1,349 n miles (2,500 km; 1,553 miles)

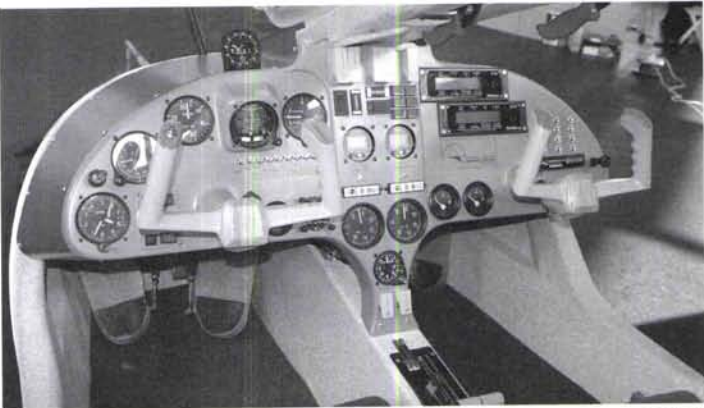
English name: Whale
TYPE: Four-seat utility twin.
PROGRAMME: Started October 2001; revealed at Friedrichshafen air show, April 2003; prototype completed at that time; maiden flight achieved (SP-YEN) 8 August 2003; planned certification to JAR 23, Normal category. Seen as progenitor of family of 10 variants which would eventually include six-seat, pressurised, retractable-gear and amphibious versions, some of them with Diesel or turboprop power plants. Prototype of EM-11 C (SP-YEP), described as 'final basic' version, made public debut 10 September 2005 and maiden flight 20 October 2005; has fully retractable landing gear, roomier cockpit with baggage space and other refinements.
CURRENT VERSIONS: **Rotax 912 versions:** Four-seat executive/tourer; executive/cargo; rescue/ambulance; FLIR-carrying reconnaissance.
Diesel versions: Executive tourer; and E-O reconnaissance with radar and data downlink. Twin diesels of 101 to 149 kW (135 to 200 hp).
Turboprop versions: Executive with pressurised cabin and retractable gear; four-seat executive amphibian; stretched, six-seat executive with additional door; and amphibious version of last-named. Twin turboprops of 261 to 298 kW (350 to 400 shp) or turbofans in PW610 class.
Surveillance versions: Optional fitment of various ventral radar fairings, EO turrets and wing leading-edge sensor pods. Taller fin, increasing height overall to 3.06 m (10 ft 0½ in); or with ventral radome 3.16 m (10 ft 4½ in) plus increase of wing span to 16.00 m (52 ft 6 in).
Turbofan versions: Twin overwing P&WC PW610 or similar turbofans.
DESIGN FEATURES: Multirole capabilities and near-STOL runway requirements. High-mounted, tapered wings with twin pusher engines; tadpole-shaped fuselage with sweptback fin and rudder; tapered, low-set horizontal tail surfaces. Underfuselage conformal planing hull attachment on amphibious versions, plus fixed floats underwing.
FLYING CONTROLS: Conventional and manual. Flaps and ailerons each constructed in left and right halves; horn-balanced elevator with flight-adjustable tab; horn-balanced rudder with adjustable tab.
STRUCTURE: All-composites.
LANDING GEAR: Tricycle type; fixed on SP-YEN, retractable on SP-YEP. Fuselage-mounted, self-sprung cantilever legs on SP-YEN. Mainwheels size 6.00-6; trailing-link nosewheel, size 5.00-5.
POWER PLANT:
SP-YEN: Two 73.5 kW (98.6 hp), wing-mounted Rotax 912 ULS flat-four engines, each driving a Woodcomp three-blade constant-speed pusher propeller. Two fuel tanks in each wing, combined capacity 240 litres (63.4 US gallons; 52.8 Imp gallons).
SP-YEP: Two 119 kW (160 hp) Textron Lycoming IO-320 flat-four engines.
Diesel (101–149 kW; 135–200 hp) and turboprop (261–298 kW; 350–400 shp) engines envisaged for later versions.
ACCOMMODATION: Four seats in tandem pairs. Gull-wing windcreens/doors, hinged on centreline and opening upward. Baggage space aft of seats, expandable by folding or removal of three passenger seats.



Prototype MMZL EM-11 Orka 1159187



MMZL EM-11 C retractable gear Orka (Paul Jackson) 1159143



Instrument panel of MMZL EM-11 Orka (Paul Jackson) 0580838

AVIONICS: VFR or IFR, according to version.

DIMENSIONS, EXTERNAL:

Wing span	13.50 m (44 ft 3½ in)
Wing aspect ratio	10.9
Length overall	8.85 m (29 ft 0½ in)
Fuselage: Max width	1.30 m (4 ft 3¼ in)
Max depth	1.25 m (4 ft 1¼ in)
Height overall	2.62 m (8 ft 7¼ in)
Tailplane span	3.70 m (12 ft 1¾ in)
Wheel track	2.42 m (7 ft 11¼ in)
Wheelbase	3.38 m (11 ft 1 in)
Distance between propeller centres	2.97 m (9 ft 9 in)

AREAS:

Wings, gross	16.65 m ² (179.2 sq ft)
--------------	------------------------------------

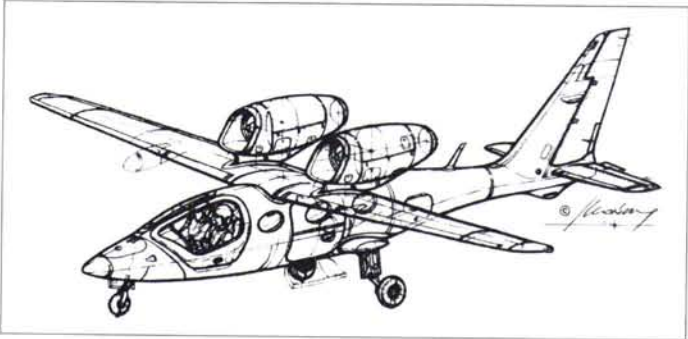
WEIGHTS AND LOADINGS (A: fixed gear/Rotax 912 prototype, B: retractable gear/IO-320):

Weight empty: A	960 kg (2,116 lb)
B	1,050 kg (2,315 lb)
Max T-O weight: A	1,375 kg (3,031 lb)
B	1,650 kg (3,637 lb)



EM-11 C Orka retractable gear version 1159188

Max wing loading: A	82.6 kg/m ² (16.92 lb/sq ft)
B	99.1 kg/m ² (20.30 lb/sq ft)
Max power loading: A	9.35 kg/kW (15.37 lb/hp)
B	13.87 kg/kW (22.78 lb/hp)
PERFORMANCE (estimated; A and B as above):	
Max level speed: A	135 kt (250 km/h; 155 mph)
B	189 kt (350 km/h; 217 mph)
Cruising speed: A	113 kt (210 km/h; 130 mph)
B	151 kt (280 km/h; 174 mph)
Min control speed (VMC): A	59 kt (110 km/h; 68 mph)
Stalling speed, flaps down: A	49 kt (90 km/h; 56 mph)
B	52 kt (95 km/h; 60 mph)
Max rate of climb at S/L: A	240 m (787 ft)/min
T-O run: A	300 m (985 ft)
B	250 m (820 ft)
Landing run: A, B	300 m (985 ft)
Max range: A	432 n miles (800 km; 497 miles)
B	809 n miles (1,500 km; 932 miles)



Sketch of projected turbofan EM-11 Orka

1159134

PZL

POLSKIE ZAKŁADY LOTNICZE SP. Z O.O
(POLISH AVIATION FACTORY LTD)

ulica Wojska Polskiego 3, PL-39-300 Mielec
Tel: (+48 17) 788 64 56 and 788 79 21
Fax: (+48 17) 788 72 26 and 788 78 29
e-mail: pzl@ptc.pl
Web: www.pzlmielec.pl
PRESIDENT: Zbigniew Działowski
VICE-PRESIDENTS:
Kazimierz Strugała (Operational)
Teresa Orczykowska (Commercial)
Tadeusz Skubisz (Development)
COMMERCIAL DIRECTOR: Marian Stachowicz

CURRENT VERSIONS: **M18B**: Standard production version from mid-1996.

Improved performance development of M18A, awarded extension of Polish type certificate 27 January 1994; FAA certification granted 19 December 1995. Elevators have smaller, centrally located trim tabs; spring interconnect between elevators and flaps, and between ailerons and rudder; flaps-down deflection increased from 15 to 30°; maximum payload and overload MTOW increased. Normal category landing run reduced; flaps-down stalling speed reduced; lower control stick force values; enhanced static and dynamic longitudinal stability. Power plant and hopper as for M18A. More recent detail improvements have included 20 cm (8 in) lengthening of tailwheel leg; 20 per cent more efficient oil cooler; hydraulic (instead of multipiston) gear pump; third hinge added to rudder; anti-collision lights at wingtips instead of on fuselage; aerodynamic air scoop for ventilation system; main-gear leg fairings; hopper filling system for liquid chemicals on both sides of fuselage; and foaming agent loading system with special onboard pump.

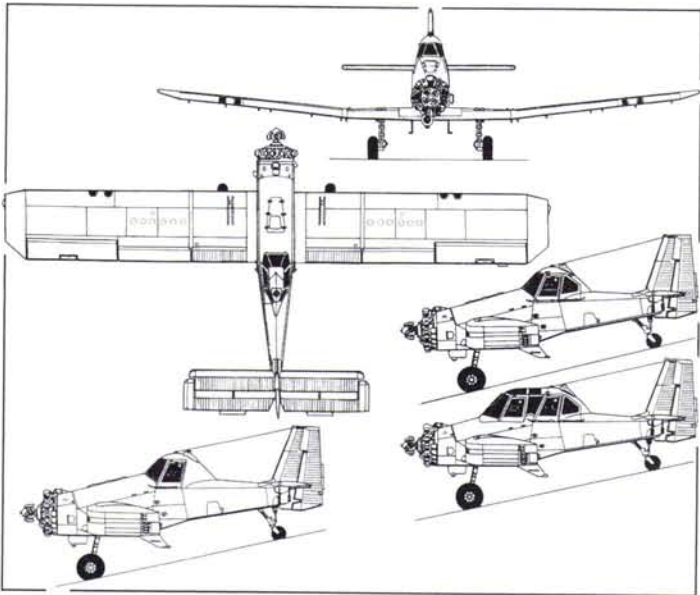
Detailed description applies to M18B except where indicated.

M18BS: Two-seat dual-control trainer, generally as M18AS, but using M18B airframe. Prototype (SP-ZUW, converted from an earlier M18) first flew in November 1997. Polish type certificate awarded early 1998. Front (instructor's) seat reduces hopper capacity to 900 litres (238 US gallons; 198 Imp gallons) or 500 kg (1,102 lb). Two produced for Iranian operator and six for Hellenic Air Force. Improved M18B, with 895 kW (1,200 hp) PZL Kalisz K-9 engine (previously reported as M18C), flown in August 1995; Type Certificate amended for this version 23 March 2005.

Turbine Dromader: Turboprop versions with 761 to 875 kW (1,020 to 1,173 shp) P&WC PT6A-45A/B/R or PT6A-65R/AG/AR engines with Hartzell propeller. Developed initially by James Mills Turbines Inc in USA and continued by Turbine Conversions Ltd. Variants with Honeywell 746 kW (1,000 shp) TPE331-10 or T53-L-7 also available from respective STC holders.

CUSTOMERS: Total of 744 built (all versions) by end of 2005, including six to Brazil. Others to Iran as kits. Approximately 90 per cent for export; sold to operators in Argentina, Australia, Brazil, Bulgaria, Canada, Chile, China, Cuba, former Czechoslovakia and East Germany, Greece (30 for firefighting), Hungary, Iran, Italy, Morocco, Nicaragua, Poland, Portugal, Spain, Swaziland, Trinidad, Turkey, USA (more than 200), Venezuela and former Yugoslavia.

DESIGN FEATURES: Emphasis on crew safety (cockpit located behind large mass concentrations of power plant and hopper; reinforced cockpit structure and roof for higher crashworthiness in case of turnover; wire cutters forward of cockpit; windscreen bird-impact resistant; fuel tanks in outboard wings, away from cockpit; steel cable between cockpit and fin for vertical tail protection against collision with overhead power lines). No members of fuselage load-carrying truss extend through hopper. All major airframe component assemblies interchangeable, with no individual fitting required. Mainwheels not subject to lateral travel during shock-absorbers' deflection, thus reducing tyre wear-off. Expansion mandrels used in centre-section-to-outboard wing attachment joints for facilitated installation and removal. Whole aircraft, in disassembled condition, with operational and ground maintenance equipment, can be carried in a single 12.2 m (40 ft) container. All parts exposed to chemical contact treated with polyurethane or epoxy enamels, or manufactured of stainless steel;



PZL M18B Dromader, with additional side elevations (right) of M18BS training version (lower) and original M18 (upper)

1159133



Greek Air Force PZL M18B Dromader

1159180

detachable fuselage side panels for airframe inspection and cleaning; braced tailplane.

Wing sections NACA 4416 at root, NACA 4412 at end of centre-section and on outer panels; incidence 6°.

FLYING CONTROLS: Conventional and manual. Mass and aerodynamically balanced slotted ailerons with trim tabs, actuated by pushrods; aerodynamically and mass-balanced rudder and horn-balanced elevators with trim tabs, actuated by cables and pushrods respectively; hydraulically actuated two-section trailing-edge slotted flaps. Control surface movements: ailerons +21/-17°; elevators +27/-17°; rudder ±23°; flaps max 30°.

STRUCTURE: All-metal; steel-capped duralumin wing spar; fuselage mainframe of helium-arc welded chromoly steel tube, oiled internally against corrosion; duralumin fuselage side panels and stainless steel bottom covering; corrugated inboard flap and tail unit skins.

LANDING GEAR: Non-retractable tailwheel type. Oleo-pneumatic shock-absorber in each unit. Wing-mounted main units have 800×260 tyres and are fitted with hydraulic disc brakes, parking brake and wire cutters. Fully castoring tailwheel, lockable for take-off and landing, with tyre size 380×150.

POWER PLANT: One PZL Kalisz ASZ-621R nine-cylinder radial air-cooled supercharged engine (731 kW; 980 hp at 2,200 rpm), driving a PZL Warszawa AW-2-30 four-blade constant-speed aluminium propeller. Integral fuel tank in each outer wing panel, combined usable capacity 712 litres (188 US gallons; 157 Imp gallons). Gravity feed header tank in fuselage. For ferrying, additional fuel capacity in chemical hopper. Oil capacity 70 litres (18.5 US gallons; 15.4 Imp gallons).

ACCOMMODATION: Single adjustable seat in fully enclosed, sealed and ventilated cockpit stressed to withstand a high g impact. Additional cabin located behind cockpit and separated from it by a wall. Latter equipped with rigid, rear-facing seat with protective padding and safety belt, port-side jettisonable door, windows (port and starboard), fire extinguisher and ventilation valve. Communication with pilot provided via window in dividing wall, and by intercom. In M18BS, standard hopper is replaced by smaller one, permitting installation of bolT-On instructor's cabin. Standard hopper of M18B and instructor's cockpit of M18BS interchangeable. Glass fibre cockpit roof and rear fairing, latter with additional small window each side. Front cockpit of M18BS has more extensive glazing. Adjustable shoulder-type safety harness. Adjustable rudder pedals. Quick-opening door on each side of front cockpit; port door jettisonable.

SYSTEMS: Hydraulic system, pressure 98 to 137 bar (1,421 to 1,987 lb/sq in), for flap actuation, disc brakes and dispersal system. Electrical system powered by 28.5 V 100 A generator, with 24 V 28 Ah lead-acid battery and overvoltage protection relay.

AVIONICS: *Comms:* Bendix/King KX 155 or KY 196A com transceiver.

Instrumentation: KI 208 course indicator, VOR-OBS indicator, artificial horizon with turn and bank indicator, gyrocompass, radio compass, transponder and stall warning.

EQUIPMENT: Glass fibre epoxy hopper, with stainless steel tube bracing, forward of cockpit; capacity 2,500 litres (660 US gallons; 550 Imp gallons) of liquid or 2,200 kg (4,850 lb) of dry chemical. Smaller hopper (see Current Versions) in M18BS. Deflector cable from cabin roof to fin.

M18 can be fitted optionally with several different types of agricultural and firefighting systems, as follows: spray system with 54/96 nozzles on spraybooms; dusting system with standard, large or extra large spreader; atomising system with 10 atomisers; water bombing installation; fire-bombing installation with foaming agents; and multifunction firefighting system (water bombing or sequential line-drops). Aerial application roles can include seeding, fertilising, weed or pest control, defoliation, forest and bush firefighting, and patrol flights.

Special wingtip lights permit agricultural flights at night, and aircraft can operate in both temperate and tropical climates. Navigation lights, cockpit light, instrument panel lights and two rotating beacons standard; wingtip positioning/strobe lights optional. Landing lights and taxiing light; night working lights optional. Built-in jacking and tiedown points in wings and rear fuselage; towing lugs on main landing gear. Cockpit fire extinguisher and first aid kit.

DIMENSIONS, EXTERNAL:

Wing span	17.70 m (58 ft 0 3/4 in)
Wing chord, constant	2.29 m (7 ft 6 1/4 in)
Wing aspect ratio	7.8
Length overall	9.47 m (31 ft 1 in)
Height, over tailfin	3.90 m (12 ft 9 1/2 in)
overall (flying attitude)	4.60 m (15 ft 1 in)
Tailplane span	5.90 m (19 ft 4 1/4 in)
Wheel track	3.48 m (11 ft 5 in)
Propeller diameter	3.30 m (10 ft 10 in)
Propeller ground clearance (tail up)	0.23 m (9 in)

DIMENSIONS, INTERNAL:

Hopper volume	2.5 m ³ (88 cu ft)
---------------	-------------------------------

AREAS:

Wings, gross	40.00 m ² (430.5 sq ft)
Ailerons (total)	4.33 m ² (46.61 sq ft)
trailing-edge flaps (total)	5.16 m ² (55.54 sq ft)
Vertical tail surfaces (total)	3.60 m ² (38.75 sq ft)
Horizontal tail surfaces (total)	7.58 m ² (81.59 sq ft)

WEIGHTS AND LOADINGS (M18B, A: Normal category, B: CAM 8):

Max payload	2,200 kg (4,850 lb)
Max fuel weight	510 kg (1,124 lb)
Max T-O weight: A	4,200 kg (9,259 lb)
B	5,300 kg (11,684 lb)
Max wing loading: A	105.0 kg/m ² (21.51 lb/sq ft)
B	132.5 kg/m ² (27.14 lb/sq ft)
Max power loading: A	5.75 kg/kW (9.45 lb/hp)
B	7.26 kg/kW (11.92 lb/hp)

PERFORMANCE (M18B; A and B as above):

Never-exceed speed (VNE):	
A	151 kt (280 km/h; 174 mph)
B	124 kt (230 km/h; 142 mph)

Max operating speed: A	124 kt (230 km/h; 143 mph)
B	108 kt (200 km/h; 124 mph)
Max airspeed with agricultural equipment:	
A, B	108 kt (200 km/h; 124 mph)
Stalling speed, flaps down: A	59 kt (108 km/h; 68 mph)
B	66 kt (121 km/h; 76 mph)
Max rate of climb at S/L: A	390 m (1,280 ft)/min
B	264 m (866 ft)/min
Service ceiling: A	6,500 m (21,320 ft)
T-O run: A	240 m (790 ft)
B	350 m (1,150 ft)
T-O to 15 m (50 ft): A	920 m (3,020 ft)
B	530 m (1,740 ft)
Landing from 15 m (50 ft): A	360 m (1,180 ft)
B	570 m (1,870 ft)
Max range, no reserves:	
A, normal tankage	523 n miles (970 km; 602 miles)
B, normal tankage	432 n miles (800 km; 497 miles)
A, with hopper fuel	1,079 n miles (2,000 km; 1,242 miles)
g limits: A	+3.4/-1.4
B	+2.8/-1.1

PZL M26 ISKIERKA

English name: Little Spark

Export marketing name: Air Wolf

TYPE: Primary prop trainer/sportplane.

PROGRAMME: Two versions developed; first flight of first prototype (SP-PIA) with PZL-F engine 15 July 1986; first flight of Textron Lycoming-engined prototype (SP-PIB) 24 June 1987. Second prototype used as US demonstrator until destroyed on 17 August 1995. Polish certification obtained 26 October 1991. No production of M26 00 (PZL-F engine and Polish avionics); production of M26 01 launched second quarter 1994 with initial 20 aircraft order from US distributor Melex; deliveries to USA began July 1996 with first production aircraft (N2601M). US FAR Pt 23 certification received 16 April 1998; also has Australian certification (both for Lycoming version). No recent orders, but remains available; EASA Type Certificate A 057 issued 24 October 2005.

CURRENT VERSIONS: **M26 01:** Textron Lycoming AEIO-540-L1B5 engine and Bendix/King avionics; *as described*. Most US aircraft are registered with type designation 'M2601'.

CUSTOMERS: Initial order for M26 01 by Melex USA Inc (20), of which two (fourth and fifth aircraft) delivered to Venezuelan National Guard Training Centre at Porlamar, Isla Margarita, in 1998. Short-listed by Israel Defence Force as Piper Super Cub replacement, but not selected. Sixth production aircraft to USA early 1999. Seventh production aircraft completed in August 2000 and retained in Poland; deliveries up to end of 2002 comprised four (plus second prototype and refurbished first prototype) to USA; two to Venezuela; current demonstrator; two then due for delivery in early 2003 to Aeroclub of Poland, which had option for unspecified number of further deliveries.

PZL M28B BRYZA

English name: Breeze

NATO reporting name: Cash

TYPE: Twin-turboprop transport.

PROGRAMME: Developed by Antonov in former USSR as An-28; robust utility transport for service on Aeroflot's shortest routes, particularly those operated by An-2s into places relatively inaccessible to other fixed-wing aircraft; official Soviet flight tests completed 1972; first preproduction An-28 (SSSR-19723) originally retained same engines as prototype, but re-registered SSSR-19753 April 1975 when flown with current engines; production assigned to PZL Mielec 1978; temporary Soviet NLS-2 type certificate awarded 4 October 1978 to second Soviet-built preproduction aircraft.

Polish manufacture of An-28 started with initial batch of 15; first flight (SSSR-28800) 22 July 1984; version received full Soviet type certificate 7 February 1986. All recent Polish production for domestic naval and military use only. Potential for future re-engining programme following cessation of PZL-10S production; two with Canadian turboprops to be delivered in 2006.

CURRENT VERSIONS: **M28B Bryza 1RM:** Originally designated An-28RM Bryza 1RM (*Ratownictwa Morskiego*; maritime reconnaissance). Prototype (SP-PDC) first flown June 1992; to Polish Navy June 1993 for evaluation; later upgraded and redelivered (as 0810) March 1999. First production example (serial number 1022) delivered 25 October 1994 and since upgraded; two further examples (1008 and 1017) ordered January 1998 and delivered March 1999 to No. 3 Naval Air Arm Division at Siemowice. These were supplied, and earlier aircraft upgraded, with Bendix/King Silver Crown avionics. Further four aircraft (1006 and 1114 to 1116) delivered in 2000-01. Upgrade of all eight has continued with introduction of Hartzel five-blade propellers (mid-2000); and semi-retractable landing gear (first flown on 0810 on 29 January 2003) and modified nose housing new (RDR-2000)



Polish Navy Bryza 1RMbis '0810'

1179199

For details of the latest updates to *Jane's All the World's Aircraft* online and to discover the additional information available exclusively to online subscribers please visit
jawa.janes.com

weather radar. In this configuration, aircraft is redesignated **IRMBis** (see below). Further plans include provision for additional fuel tankage.

M28B Bryza 1RMBis: Configured for special missions such as detection of objects on sea surface; lead-in and call-in search and rescue; maritime patrol and submarine detection. Installed equipment to meet these objectives includes ARS-800 radar coupled with FLIR system; magnetic anomaly detector; radio-buoy airdrop system with data receiving and processing system; and national datalink system. To optimise radar performance, main landing gear retracts sideways and nose gear into fuselage. First flight in this configuration (by 0810), 29 January 2003.

M28B Bryza 1TD: (*Towarna Desantowegoi*; cargo transport/airdrop): Transport/paradrop version, designated for airdrop of paratroops or cargo containers, with folding seats, static lines and roller floor as appropriate. In medevac configuration, attachment provisions for six stretchers, oxygen mask container, resuscitator and medicare containers. Clamshell rear doors replaced by single door sliding forward under fuselage, similar to that of An-26. Previously known as An-28BIT, then An-28TD.

Prototype (SP-PDE) completed as B1 September 1991; to TD configuration May 1994 and to Air Force (as 0723) for evaluation May 1995; returned to PZL 1996. First production TD (1003) to Polish Air Force October 1994. Further 10 ordered for Polish Air Force in series of contracts beginning 16 May 2001; deliveries began 26 March 2002 with 0203 and 0204; followed by 0205 and 0206 in May 2002, 0207 and 0208 in May 2003; 0209 and 0210 accepted in September 2004, 0211 and 0212 in March 2005. Four of this batch delivered with Litton M949 NVGs.

Polish Navy also operates two TDs (1117 and 1118), plus one aircraft (1007) originally converted from an An-28 as Bryza 2RF elint aircraft but delivered unequipped on 22 November 1996 and operated only in transport role.

M28B/PT: Two aircraft (serials 0301 and 0302) with P&WC PT6A-65B engines; to be delivered to Polish Air Force in 2006.

M28M Bryza E: Two Polish Navy aircraft (0404 and 0405, originally delivered as An-28s in October 1988) equipped in 2000-01 with Swedish Space Corporation (Eriasson) MSS 5000 maritime surveillance system for ecological monitoring; 0405 recommissioned 28 November 2000; both redelivered to Polish Navy 18 January 2002; based at Gdynia. In these aircraft, single rear door is replaced by twin doors opening hydraulically inward, and additional side door installed in forward fuselage.

CUSTOMERS: Bryza deliveries to Polish Navy totalled 13 by May 2002, comprising eight IRMs, two Es, two TDs and one 2RF; these equip the 3rd Division at Siemowice. Delivery to Polish Air Force of the 10 Bryza 1TDs ordered in May 2001 was completed in January 2005. Eight of these equip 13th Transport Regiment at Krakow; remaining two operated by 36th Special Air Transport Regiment at Warsaw-Okęcie in VIP transport role and are fitted with ventral cargo panner.

Two Skytrucks equivalent to Bryza 1RMBis ordered by Vietnam People's Army Air Force in October 2003; delivered, minus surveillance radars, 30 December 2004.

COSTS: M28B/PT contract (two aircraft), PLN57.83 million (2005).

POWER PLANT: Two WSK-Rzeszów 716 kW (960 shp) TWD-10B/PZL-10S turboprops, each driving a AW-24AN three-blade or Hartzell HC-B5MP-3D five-blade propeller; first aircraft with latter was 0810, redelivered to Polish Navy on 27 August 2000. M28B/PT has 1,026 kW (1,376 shp) PT6A-65B engines.

Fuel in two 670 litre (177 US gallon; 147.4 Imp gallon) outer wing tanks and one 620 litre (164 US gallon; 136.4 Imp gallon) centre-section tank, giving total capacity of 1,960 litres (518 US gallons; 431 Imp gallons). Programme to install auxiliary tanks on landing gear sponsons was under development in 2002; no recent news of progress with this.

ACCOMMODATION (BRYZA 1RM AND 1RMBis): Pilot, co-pilot, engineer and three systems operators.

AVIONICS (BRYZA 1RM): *Comms:* LS-10 subsystem; SC-10D2 IFF transponder; NATO-compatible IFF.

Radar: PIT (Przemysłowy Instytut Telekomunikacji) ARS-400 360° search and surveillance radar (86 n mile; 160 km; 99 mile range), in underfuselage radome; Honeywell RDR-2000 weather radar in nose.

Flight: Include Bendix/King KNS 81S navigation system and KLN 90B GPS receiver. *Mission:* Chelton DF 707-1 emergency locator system.

AVIONICS (BRYZA 1RMBis): *Comms:* SC-10D2 IFF transponder.

Radar: PIT ARS-800 synthetic aperture search radar in underfuselage radome; Honeywell RDR-2000 weather radar in nose.

Flight: Bendix/King KFC 325 AFCS, KLN 900 GPS navigation system and KNR 634A nav receiver; LCR 92 laser gyro platform; Chelton DF system.

Mission: SRM-800 maritime surveillance system; MAG-10 magnetometer; HYD-10 submarine detection (sonobuoy) system; LS10M (Link 11) automatic data transmission system; Star SAFIRE II FLIR turret in redesigned nose.

Self-defence: ESM-10 ESM system.

EQUIPMENT (BRYZA 1RMBis): ACR/RLB-14 radio marker buoys; two 100 kg (220 lb) SAB-100NM illumination flares; five six-seat Mewa-6 dinghies, including two for crew.

DIMENSIONS, EXTERNAL As M28 Skytruck except:

Propeller diameter: AW-24AN	2.80 m (9 ft 2 1/4 in)
Hartzell	2.82 m (9 ft 3 in)
Cargo door: Height	2.60 m (8 ft 6 1/4 in)
Width	1.20 m (3 ft 11 1/4 in)

DIMENSIONS, INTERNAL:

Cabin: Length (excl flight deck)	5.26 m (17 ft 3 in)
Max width	1.74 m (5 ft 8 1/2 in)
Max height	1.72 m (5 ft 7 3/4 in)

WEIGHTS AND LOADINGS:

Basic weight empty	4,050 kg (8,929 lb)
Weight empty, equipped	4,350 kg (9,590 lb)
Max fuel weight	1,766 kg (3,893 lb)
Max payload	2,000 kg (4,409 lb)
Max T-O and landing weight	7,500 kg (16,534 lb)
Max power loading	5.24 kg/kW (8.61 lb/shp)

PERFORMANCE:

Max operating speed (VMO)	189 kt (350 km/h; 217 mph)
Unstick speed	73 kt (135 km/h; 84 mph)
Touchdown speed	76 kt (140 km/h; 87 mph)
Stalling speed, flaps up	57 kt (104 km/h; 65 mph)
Max rate of climb at S/L	540 m (1,772 ft)/min
Time to 3,000 m (9,840 ft)	6 min 43 s
Service ceiling	6,000 m (19,680 ft)
Service ceiling, OEI	3,500 m (11,480 ft)
T-O run	440 m (1,445 ft)
T-O to 10.7 m (35 ft)	570 m (1,870 ft)
Landing from 15 m (50 ft)	750 m (2,460 ft)
Landing run	330 m (1,085 ft)

Max range, 45 min reserves	809 n miles (1,500 km; 932 miles)
Max endurance at 3,000 m (9,840 ft)	6 h 30 min

PZL M28 05 SKYTRUCK

TYPE: Twin-turboprop transport.

PROGRAMME: Westernised development of the Antonov An-28, with Polish power plant and avionics replaced by P&WC PT6A-65B turboprops, Hartzell five-blade propellers and Bendix/King nav/com, weather radar and other equipment. Prototype conversion (SP-PDF) begun early 1991; first flight July 1993; Polish temporary type certificate to FAR Pt 23 Amendment 34 granted March 1994; permanent certificate March 1996, permitting MTOW increase to 7,000 kg (15,432 lb) for M28 01 and 02; Indonesian certification for M28 02, 14 April 2004, M28 05 certified to FAR Pt 23 Amendment 42 on 18 April 2002 for increased gross weight version (7,500 kg; 16,534 lb), a prototype of which was completed in 1996. Full FAA certification of M28 05 received 19 March 2004. US distributor is Skytruck Company LLC of Naples, Florida. Indonesian Type Certificate superseded by EASA A 058 on 24 October 2005.

CURRENT VERSIONS: **M28 05 Skytruck:** As described.

M28 05-SG Skytruck: Maritime patrol/search and rescue version for Polish Border Guard. Surveillance system comprises Polish multifunction maritime radar; FLIR; MSS 6000 pollution detection system; searchlight; direction finder; special communication systems; still photo camera and video camera; NVGs (flight deck); external navigation lights compatible with night vision imaging system; and emergency beacon. Additional onboard equipment includes four liferafts, lifejackets and personal radio transmitters. Passenger/patrol seating and stretchers optional.

M28B Bryza: Amended designation of current production military derivatives of An-28; described separately.

M28 03/04 Skytruck Plus: Provisional designation for projected stretched version.

CUSTOMERS: Total 39 built and delivered by April 2006. First customer delivery (HK-4066X to Latina de Aviación de Colombia) made in January 1996; firm orders totalled 12 at that time, including six for Venezuelan National Guard (deliveries to which began in December 1996); equip Air Detachment 5 at Caracas (four), AD 3 at Maracaibo (one) and AD 9 at Puerto Agoucho (one). One delivered to Aerogryf in Poland in mid-1996; and one to USA (subsequently to Honduras) in 1997; one to Venezuelan civil operator in 2000, but lost in July 2001. Venezuelan National Guard order subsequently (1997) increased to 12, second-batch deliveries beginning mid-1999 and completed (with single M28 02 Executive) in 2000. Twelve M28 05 ordered by Venezuelan Army; first deliveries April 2000; completed in 2001.

One (RAN-41) delivered to Royal Nepal Army on 7 November 2002 for 11th Brigade at Kathmandu; second ordered October 2003, with further two then in prospect.

In late October 2003, Vietnamese Coast Guard ordered first two of 'at least eight to 10' Skytrucks required for maritime surveillance and border control missions; delivered in late December 2004, initially in mixed, passenger/transport configuration but later to be equipped with maritime surveillance system.

Indonesian government announced intention to buy Skytrucks for Navy on 4 May 2004, this following a late 2003 contract for four for Indonesian Police, delivered by end of 2004 in passenger/transport configuration. Contract for former batch (10 aircraft) signed 18 August 2005; these to comprise three passenger/cargo transports, generally similar to Bryza 1TD, and seven in maritime patrol configuration with surveillance system, including ARS-400M radar and L-3 Wescam MX-15 EO/IR sensor turrets. Deliveries of all 10, to Indonesian Navy base at Juanda, were due to be completed by end of 2006.

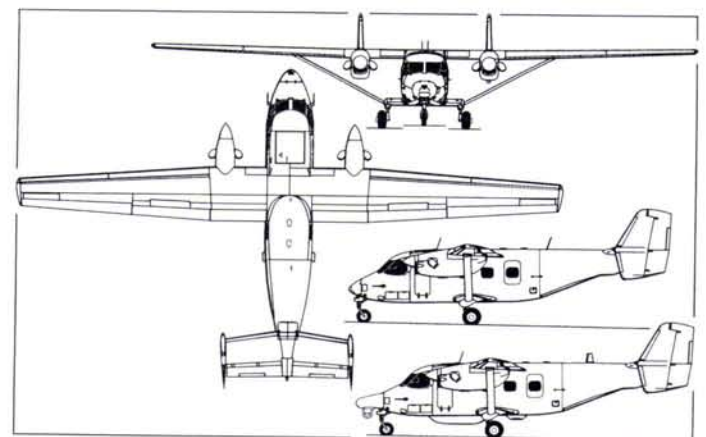
COSTS: Indonesian Navy contract (10 aircraft, plus crew training) reportedly valued at approximately USD75 million.

DESIGN FEATURES: Inherited An-28's ability to operate from short, austere airfields; added Western engines and avionics to improve export sales prospects. Braced wings; will not stall



M28 Skytruck of Indonesian Police

1179198



PZL M28 05 Skytruck twin-turboprop transport, with additional side view (lower) of M28 05-SG maritime version (Paul Jackson)

1159132

because of action of automatic slats. Short stub-wing extends from lower fuselage to carry main landing gear and support wing bracing struts, curving forward and downward at front to serve as mudguards; underside of rear fuselage upswept, incorporating clamshell doors for passenger/cargo loading; twin fins and rudders, mounted on inverted-aerofoil, no-dihedral fixed incidence tailplane.

Wing section CAHI (TsAGI) R-II-14; thickness/chord ratio 14 per cent; constant chord, non-swept, no-dihedral centre-section, with 4° incidence; tapered outer panels with 2° dihedral, negative incidence and 2° sweepback at quarter-chord.

FLYING CONTROLS: Manual. Single-slotted mass and aerodynamically balanced ailerons (port aileron has trim tab), designed to droop with large, hydraulically actuated, two-segment double-slotted flap; electrically actuated trim tabs in elevator have manual back-up; twin rudders each with electrically actuated trim tab; automatic leading-edge slats over full span of wing outer panels; slab-type spoiler forward of each aileron and each outer flap segment at 75 per cent chord; fixed slat under full span of tailplane leading-edge. If an engine fails, patented upper surface spoiler forward of aileron on opposite wing is opened automatically, resulting in wing bearing dead engine dropping only 12° in 5 seconds instead of 30° without spoiler; patented fixed tailplane slat improves handling during high angle of attack climb-out; under icing conditions, if normal anti-icing system fails, ice collects on slat rather than tailplane, to retain controllability.

STRUCTURE: Mostly metal; duralumin ailerons with fabric covering; duralumin slats with CFRP skins; CFRP spoilers and trim tabs. Air intakes lined with epoxy laminate. Two-spar wing with integral fuel tanks between spars.

LANDING GEAR: Non-retractable tricycle type, with single wheel and PZL oleo-pneumatic shock-absorber on each unit. Main units, mounted on small stub-wings, have wide tread balloon tyres, size 720x320, pressure 5.50 bar (80 lb/sq in). Steerable (±50°) and self-centring nosewheel, with size 6.5–10 Goodyear tyre, pressure 6.00 bar (87 lb/sq in) or 595x185–280 Stomil (Poland) tyre, pressure 3.50 bar (51 lb/sq in). Multidisc, anti-lock hydraulic brakes on main units, and inertial anti-skid units. Reinforced landing gear and brakes optional. Minimum ground turning radius 16.00 m (52 ft 6 in). Ski and float gear under development.

POWER PLANT: Two 820 kW (1,100 shp) Pratt & Whitney Canada PT6A-65B turboprops, each driving a Hartzell HC-B5MP-3D10876ASK five-blade, fully feathering propeller with reverse pitch. Two main fuel tanks in outer wings, each 660 litres (174 US gallons; 145 Imp gallons); two auxiliaries in wing centre-section, each 290 litres (76.6 US gallons; 63.8 Imp gallons); two auxiliary tanks in outer wings, each 189 litres (49.9 US gallons; 41.6 Imp gallons); total wing fuel thus 2,278 litres (602 US gallons; 501 Imp gallons). Auxiliary tanks gravity-filled; main tanks by pressure or gravity. For self-ferry only, additional fuel can be carried in tank in main cabin. Oil capacity 16 litres (4.2 US gallons; 3.5 Imp gallons) per engine.

ACCOMMODATION: Pilot and co-pilot on flight deck, which has bulged side windows and electric anti-icing for windscreens, and is separated from main cabin by bulkhead with connecting door. Dual controls standard. Jettisonable emergency door on each side. Standard cabin layout of passenger version has seats for 19 people, with seven single seats on port side and six double seats on starboard side of aisle, at 72 cm (28 in) pitch. All seats easily foldable or removable for carriage of cargo. Aisle width 35.4 cm (13.9 in). Five passenger windows each side of cabin. Seats fold back against walls when aircraft is operated as a freighter or in mixed passenger/cargo role, seat attachments providing cargo tiedown points. Hoist of 500 kg (1,102 lb) capacity able to deposit cargo in forward part of cabin. Alternative interior configurations for 17 parachutists; or six stretchers, eight seated casualties and two medical attendants.

Entire cabin heated, ventilated, soundproofed and, optionally, air conditioned. Inward/upward-opening, hydraulically operated doors for passenger and cargo loading. Emergency exit on each side, plus a third aft of flight deck. Optional ventral pannier, increasing baggage/cargo capacity by 300 kg (661 lb).

SYSTEMS: No pressurisation or pneumatic systems. Hydraulic system powered by two engine-driven pumps, pressure 147 bar (2,132 lb/sq in), for flap, spoiler and (where fitted) cargo ramp actuation, mainwheel brakes and nosewheel steering, with emergency back-up system for spoiler extension and mainwheel braking. Optional air conditioning system, electrically powered with ground power supply back-up, reduces ambient temperatures of up to 40°C (104°F) by 10 to 12°C (18 to 22°F).

Primary electrical system is three-phase AC, with two 28 V DC 12 kW engine-driven starter/generators; two 200/115 V, 400 Hz, 1,500 VA inverters as secondary supply for windscreens heating. Two 26 Ah Ni/Cd batteries.

Electric anti-icing of flight deck windscreens, propellers, spinners and pitot heads, sufficient for short exposure to icing conditions. Oxygen system standard for crew, optional for passengers. No APU.

AVIONICS: Standard Gold Crown suite by Bendix/King.

Comms: Two KTR 908 VHF radios; two KMA 24 H70 audio selector intercoms; MST 67A transponder and encoding altimeter. Optional KHF 950 HF radio.

Radar: Optional RDR-2000 digital weather radar.

Flight: Navigation system based on two KNR 634 VOR/LOC/GS/MKR receivers for VOR/DME navigation, with two EFS 50 EHSI; two KDF 806 ADF; LCR 92S12 laser gyro; two EFS 50 EADI. Optional KLN 900 GPS and FDR. KFC 325 AFCS. KCP 220 computer and Mk VI EGPWS.

DIMENSIONS, EXTERNAL:

Wing span 22.06 m (72 ft 4½ in)
Wing chord: at root 2.20 m (7 ft 2½ in)

mean aerodynamic 1.885 m (6 ft 2¼ in)
at tip 1.10 m (3 ft 7¼ in)
Wing aspect ratio 12.3
Length overall: standard 13.10 m (42 ft 11¾ in)
maritime patrol version 13.72 m (45 ft 0¼ in)
Fuselage: Length 12.68 m (41 ft 7¼ in)
Max width 1.90 m (6 ft 2¼ in)
Max depth 2.14 m (7 ft 0¼ in)
Height overall 4.90 m (16 ft 1 in)
Tailplane span 5.14 m (16 ft 10¼ in)
Wheel track 3.39 m (11 ft 1½ in)
Wheelbase 4.36 m (14 ft 3¼ in)
Propeller diameter 2.82 m (9 ft 3 in)
Propeller ground clearance 1.06 m (3 ft 5¼ in)
Distance between propeller centres 5.20 m (17 ft 0¼ in)

Rear hydraulic doors:

Length 2.60 m (8 ft 6¼ in)
Total width: at top 0.90 m (2 ft 11½ in)
at sill 1.20 m (3 ft 11¼ in)

Emergency exits (each):

Height 0.92 m (3 ft 0¼ in)
Width 0.62 m (2 ft 0½ in)

DIMENSIONS, INTERNAL:

Cabin (excl flight deck): Length 5.26 m (17 ft 3 in)
Max width 1.74 m (5 ft 8½ in)
Max height 1.72 m (5 ft 7¾ in)
Floor area approx 7.5 m² (80.7 sq ft)
Volume approx 14.0 m³ (494 cu ft)
Pannier (optional): Height 0.38 m (1 ft 3 in)
Width 1.53 m (5 ft 0¼ in)
Volume 1.35 m³ (47.7 cu ft)

AREAS:

Wings, gross 39.72 m² (427.5 sq ft)
Ailerons (total) 4.33 m² (46.61 sq ft)
Trailing-edge flaps (total) 7.99 m² (86.00 sq ft)
Spoilers (total) 1.67 m² (17.98 sq ft)
Fins (total) 10.00 m² (107.64 sq ft)
Rudders (total, incl tabs) 4.00 m² (43.6 sq ft)
Tailplane 8.85 m² (95.26 sq ft)
Elevators (total, incl tabs) 2.56 m² (27.56 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: passenger version 4,398 kg (9,696 lb)
cargo version 4,260 kg (9,392 lb)
maritime patrol version 4,700 kg (10,362 lb)
Max fuel load 1,766 kg (3,893 lb)
Max payload: in cargo/passenger cabin 2,000 kg (4,409 lb)
in ventral baggage pod 300 kg (661 lb)
total 2,300 kg (5,070 lb)
Fuel with max payload 1,085 kg (2,392 lb)
Payload with max fuel 1,319 kg (2,908 lb)
Max T-O and landing weight 7,500 kg (16,534 lb)
Max zero-fuel weight 6,600 kg (14,550 lb)
Max wing loading 188.8 kg/m² (38.67 lb/sq ft)
Max power loading 4.57 kg/kW (7.52 lb/shp)

PERFORMANCE (at 7,000 kg; 15,432 lb AEW):

Max operating speed (VMO) 191 kt (355 km/h; 220 mph)
Econ cruising speed at FL984 146 kt (270 km/h; 168 mph)
Max manoeuvring speed (VA) 132 kt (244 km/h; 152 mph)
Min control speed (VMCA) 83 kt (153 km/h; 96 mph)
Unstick speed 73 kt (135 km/h; 84 mph)
Approach speed 70 kt (130 km/h; 81 mph)
Stalling speed, flaps up 67 kt (123 km/h; 77 mph)
Max rate of climb at S/L 690 m (2,264 ft)/min
Time to FL984: air bleed off 6 min
air bleed on 9 min
Service ceiling 7,620 m (25,000 ft)
Service ceiling, OEI 3,750 m (12,300 ft)
T-O run 255 m (835 ft)
T-O to 10.7 m (35 ft) 325 m (1,065 ft)
Landing from 15 m (50 ft) 560 m (1,835 ft)
Landing run 260 m (855 ft)

Range at FL984, 45 min reserves:

with max payload 432 n miles (800 km; 497 miles)
with max fuel 809 n miles (1,500 km; 932 miles)
self-ferry, with additional tanks in cabin 1,673 n miles (3,100 km; 1,926 miles)
Endurance 6 h 12 min
g limits +3/-1

PZL

PZL-SWIDNIK SA

aleja Lotników Polskich 1, PL-21-045 Świdnik

Tel: (+48 81) 751 20 61 and 751 35 05

Fax: (+48 81) 468 09 19 and 468 09 18

e-mail: hem@pzl.swidnik.pl

Web: www.pzl.swidnik.pl

PRESIDENT: Mieczysław Majewski

MANAGING DIRECTOR: Jan Miroski

COMMERCIAL DIRECTOR: Ryszard Cukierman

DIRECTOR OF RESEARCH AND DEVELOPMENT: Jan Pysznik

HEAD OF MARKETING: Andrzej Dyzma

HEAD OF SALES: Marzena Siwek

MARKETING MANAGER, AVIATION PRODUCTS: Andrzej Stachyra

PZL-Świdnik factory recently completed 55 years of aircraft manufacture, having been established 1 January 1951; engaged initially in manufacturing wings and control surfaces for LIM-1 (MiG-15) jet fighter; began licensed production of Soviet Mi-1 helicopter in 1954 (first

flight March 1956), building some 1,594 as SM-1s, followed by 86 Świdnik-developed SM-2s; design office formed at factory to work on variants/developments of SM-1 and original projects such as SM-4 Łatka. More than 7,300 helicopters of all types built to date, including four pre-series and 5,418 production Mi-2s from 1965; in addition, further six Mi-2 static test airframes produced. Indonesian Police ordered nine upgraded Mi-2plus helicopters in 2004, for delivery in 2005. One PZL Kania was delivered to the Polish Border Guard during 2003; further contracts in 2004 from same customer for four more Kania and one W-3 Sokół.

Świdnik works named after famous pre-war PZL designer Zygmunt Pulawski in September 1957; became a joint stock company on 4 January 1991, with Polish Treasury the major shareholder. Main shareholder from 2003 (87.61 per cent) is Industrial Development Agency, a Treasury-owned joint stock company. Workforce of 3,448 in April 2006. Production of own designs concentrates on W-3 Sokół variants and SW-4, ISO 9001 status was achieved in 1994, and on 15 June 2000 Świdnik was granted AQAP-110 certification, having fully met NATO quality assurance requirements for design, development and production.

Świdnik manufactures PW-5 Smyk (from 1994) and PW-6 composite sailplanes and (also since 1994) central wing box for ATR 72; manufacturing fuselages for AgustaWestland since 1996 (now includes A 109 E Power, A 109 LUH, A 109 S Grand, A 119 Koala and AW139; over 100 delivered in 2005 and 500th on 9 June 2006); also fuselage components for Bell/Agusta AB139, cockpit modules for Dassault Mirage 2000-5, aircraft components for

Ratier-Figeac, and baggage doors for Airbus A300/A320/A340. Co-operation agreement with Cessna, and start of Bell 412 tailboom production, announced in 2002, February 2004 MoU with Dirgantara to study feasibility of latter becoming components supplier for W-3 Sokół. In all, PZL-Świdnik is involved in some 20 international aerospace manufacturing programmes, and co-operates with 11 world aerospace companies, including Boeing, Eurocopter, GKN, Latécoère, Stork Fokker and Textron in addition to those already mentioned.

Subsidiaries include Heliseco, which operates over 100 helicopters on agricultural and similar tasks at home and in Egypt, Greece, Oman, Portugal, Spain and elsewhere.

PZL W-3 SOKÓŁ

English name: Falcon

TYPE: Multirole medium helicopter.

PROGRAMME: Developed under 1970 joint Polish/Soviet agreement; preliminary design by engineers from both countries at Mil OKB in Moscow 1972, where preliminary mockup completed 1975. Detail design and definitive mockup by Świdnik 1976; static/fatigue ground test airframe of 1978 followed by five flying prototypes, first of which (SP-PSA) made first flight 16 November 1979, and used in subsequent tiedown tests; remaining prototypes embodied changes resulting from tests; Soviet participation ended 1980. Manufacturer's flight trials resumed 6 May 1982 with second prototype (SP-PSB); third, fourth and fifth prototypes all made first flights in 1984, on 24 July (SP-PSC), 4 June (SP-PSD) and 26 November (SP-PSE) respectively; certification trials carried out in wide range of operating conditions, including heavy icing and extreme temperatures of -60 and +50°C. Provisional Polish certification 26 September 1988, followed by full certification in Poland 10 April 1990, and to Russian NLGW-1 and -2 regulations 17 December 1992; production started in 1985 and 20 early aircraft supplied to Aeroflot from 10 August 1988, but subsequently returned to Świdnik, most being reallocated to Heliseco for firefighting in Spain.

Manufacture ended in 2001, the final aircraft being sold to Krasnodar in 2003. However, USD132 million contract signed 15 December 2004, under which PZL-Świdnik to supply Iraqi Army with 20 Sokóls; 12 W-3Ws, four VIP transports and four for medevac use. First deliveries planned for November 2005.

Polish (26 March), Spanish, US (31 May) and German (6 December) FAR Pt 29 (VFR) certification of W-3A received 1993; Spanish certification followed on 20 December 2000. Polish ICAO-standard noise certification 1995; 100th example completed 1996. MoU 13 April 1996 with Daewoo, South Korea (now part of KAI), for purchase of 35 Sokóls with marketing rights in Asia, but payments (and hence deliveries) delayed due to regional economic difficulties and only a few sales in the region. Korean agreement expired April 2003 and not renewed.

Under a Polish MoD contract of October 2002, valued at approximately USD22.8 million, PZL-Świdnik is to upgrade 16 W-3W and 12 W-3WA Sokóls from 1994/2000 production to NATO-compliant (STANAG 4555) standard with Rockwell Collins AN/ARC-210 U/VHF radios, Bendix/King KLU 709 Tacan, and cockpit instrumentation compatible with the pilot's Litton M927 NVGs. The contract was due for completion in 2006.

CURRENT VERSIONS: **W-3 Sokół:** Initial civil and military version; production (52) completed. Two W-3s (0501 and 0502) upgraded by WZL 1 as **W-3RL** for combat SAR role in 1999 as part of Polish qualification for NATO membership; based at Bydgoszcz. New equipment includes Rockwell Collins search radar, Bendix/King com radios and intercom, Tacan, GPS, radio compass, IFF, searchlight, rescue hoist, stretchers (two) and auxiliary fuel tanks; standard crew of five. One conversion to **S-IRR** prototype (which see below); one other converted as **W-3U Salamandra** armed prototype but reverted to W-3 and delivered to Myanmar.

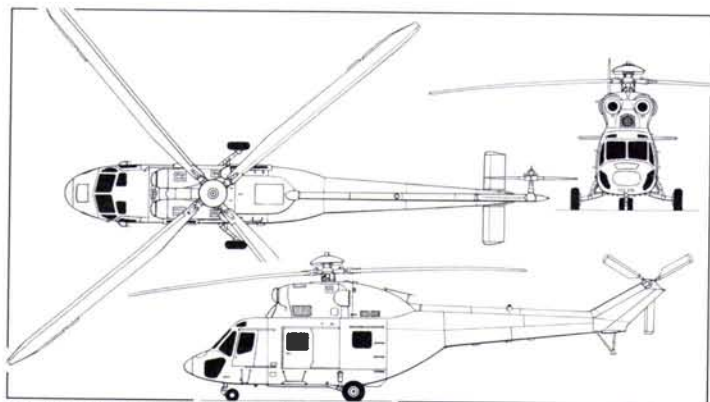
W-3W: Armed W-3 (W for *Wielozadaniowy*: multipurpose) with starboard-mounted 23 mm GSz-23 twin-barrel gun; Mars-2 launchers for sixteen 57 mm S-5 or 80 mm S-8 unguided rockets, ZR-8 bomblet dispensers, Platan minelaying packs, and six cabin window-mounted AK 47, 5.45 mm Tantal or PKM machine guns. Twenty-two delivered to Polish Ministry of National Defence; entered service with Polish Air Force 47 Szkolny Pułk Smiglowcow (Helicopter School Regiment) at Nowe Miasto (five) and Polish Army (17).

W-3A: Improved (and final standard) version for Western certification; redesign started 1989; first flight 30 July 1992; FAA type approval to FAR Pt 29 received 31 May 1993, German LBA certification 6 December 1993. Dual hydraulic systems, new de-icing system, Western instrumentation. First delivery, to Saxony Police Department, Germany, 20 December 1993.



Trio of W-3WA Sokóls of the Polish Army (Grzegorz Holdanowicz)

0532728



PZL-Świdnik W-3A Sokół twin-turboshaft helicopter (Dennis Punnett)

0507182

W-3A2: One aircraft (c/n 370508, SP-PSL) fitted in early 1998 with Smiths Industries AFCS (SN-530 four-axis digital autopilot); obtained Polish (GILC) single-pilot IFR certification 7 January 2003. Two built: one to Spain and one to South Korea.

Detailed description applies to W-3A, except where indicated.

W-3AM: Version of W-3A with six inflatable flotation bags. Thirteen, mostly for South Korea, produced by January 2002.

W-3AS: Modernised to FAR Pt 29 standards. Polish certification 24 April 2003; EASA 17 March 2005. Fourteen W-3As upgraded to W-3AS by end of 2004; further nine planned by June 2005.

W-3WA: Combat support armed version of W-3A; weapons include GSz-23L gun, Strzala-2 AAMs and Polish Gad fire-control system. Total of 27 delivered to Polish armed forces by January 2002: Air Force five, Army 18, Navy three and MoD one. Three in combat SAR configuration (presumably based on W-3RL) delivered in second quarter 2000 to 7th Cavalry Regiment at Tomaszów Mazowiecki: new comms, NVG-compatible instrumentation, new IFF, classified ESM and armoured crew seats. Four adapted in 2001 for Polish Army smoke-laying role, equipped with PWD Pylia smoke generation system developed by WSK-PZL Rzeszów and the Polish Armed Forces' Chemistry and Radiometry Military Institute; equip 66th Air Squadron, which deployed to Iraq as part of coalition forces in 2003. Avionics and armament upgrade of Polish Army W-3WAs planned to start in 2004 under programme name Gluszec (wood grouse); to include INS/GPS nav, mission computer, head-down colour MFDs, FLIR turret, new ECM suite, NATO-standard weapon carriers and MIL-STD-1553B databus.

W-3WB: (*wsparcia bojowego*: combat support): Armed prototype (c/n 360318), equipped 1993-94 by Kentron (hence alternative designation **W-3K**) with South African weapon systems. Returned to Świdnik 1994 and became HOT/Viviane testbed (see W-3H paragraph below).

W-3PPD Gipsowka: Airborne command post (*powietrzny punkt dowodzenia*) version of W-3A. Four conversions to be procured by Polish Army as Mi-2PPD replacements by 2006, first of which (0816) was delivered to 66th Air Squadron in first half of 2001. Specialised command, control and communications (C³) avionics include Thales RRC-9500 UHF (two) and RRC-3500 HF (one) radios, Totem 300 INS and a MIL-STD-1553B databus. Crew includes four operator workstations, each with a 40.6 cm (16 in) flat-panel colour display; flight deck is NVG-compatible. Also to have EW suite (as in W-3), including Thales SPS-H RWR and chaff/flare dispenser. Defensive armament is carried on external outriggers.

W-3RM Anakonda: Offshore search and rescue (*ratowniczy morski*: sea rescue) version of W-3; watertight cabin, six inflatable flotation bags, additional window in lower part of each flight deck door. In service with Polish Navy (five delivered, of which two since lost; retrofit with folding main rotor blades from late 2000); Ministry of Interior (one) and for Świdnik trials (one). Latest examples, with US FSI Ultra 4000 FLIR, are designated **W-3WARM** (first aircraft, 360813, delivered 21 May 1998; second, 360815, 15 March 1999; third, 360906, 18 January 2002), the A indicating American (FAA) certification standard and W indicating armament. Upgrade under test from 2000 includes a more advanced engine control system and a deck lock for shipboard deployment.

S-IRR Procion: Electronic combat reconnaissance (*rozpoznanie radioelektronicznego*) version of W-3; prototype (c/n 310203) converted from W-3, first flown 1996 and delivered to Polish Air Force by 1 January 1997. Subsequent aircraft designated **SRR-10 Procion-3** (alternative designation **W-3RR**): first of these (c/n 370720) first flown in 1998 and fully equipped in 1999. ECR suite includes two-place console and chaff/flare dispensers; large external antenna housings include one on nose, one on cabin roof and one on starboard side of fuselage; last-named can be rotated downwards for full 360° scan capability. Second aircraft (c/n 360907) subsequently completed.

W-3H: Unofficial designation for armed support helicopter, derived from W-3WA; pursued as upgrade under now-abandoned **Huzar** programme. Local requirement for 96. Avionics and weapons fit decided in favour of Israeli (Elbit avionics and Rafael NT-D ATM) equipment in October 1997, but selection immediately overturned by new Polish government; rival avionics offered by Boeing and Sextant, partnered by Hellfire II and HOT 3, respectively. Programme reinstated October 1998 but foundered due to inability to demonstrate NT-D in Poland within deadline of 30 November, and Israeli deal cancelled by Polish government on 8 December 1998.

September 1998 co-operation agreement between Świdnik and Euromissile led to integration of HOT 3 ATM on Sokół, followed by successful firing tests during demonstration of HOT/Viviane system at Polish firing range in Nowa Deba on 4 March 1999, using Świdnik trials aircraft: SP-SUW (c/n 360318). This aircraft utilised in 2000 as prototype to test new main rotor blades with modified leading-edges and increased damage tolerance. Świdnik continues to offer W-3/HOT 3 variant as potential export version, but domestic requirement for W-3H now shelved in favour of a 50-aircraft support role upgrade of existing Sokóls, attack requirement instead being met by upgrading Mi-24 fleet.

SW-5: Provisional designation for improved version under study in late 1990s but not pursued.

CUSTOMERS: See tables. Total of 147 (excluding five flying prototypes and three static test airframes) completed, of which 128 in service in March 2006. Iraq order for 20 in December 2004, with deliveries planned to begin in November 2005, later reduced to two, to be delivered in VIP transport configuration in mid-2006. According to a Świdnik spokesman in mid-2005, these are new-build aircraft.

DESIGN FEATURES: Conventional utility helicopter of pod-and-boom layout and with engines above cabin. Four-blade fully articulated main rotor and Three-blade tail rotor; main rotor has pendular Salomon-type vibration absorber for smooth flight and low vibration levels. Transmission driven via main, intermediate and tail rotor gearboxes. Tailfin integral with tailboom; fixed incidence horizontal stabiliser, not interconnected with main rotor control system.

Main rotor blades have NACA 23012M aerofoil section and (on Polish Navy W-3RM) manual folding. Rotor brake standard. Rotor rpm 268.5 (main) and 1,342 (tail); main rotor blade tip speed 220.7 m/s (724 ft/s). Main rotor movement +25°/20°/-4°/30°.

FLYING CONTROLS: Three hydraulic boosters for longitudinal, lateral and collective pitch control of main rotor; one booster for tail rotor control. Constant-speed rpm control for continuous operation (manual rpm control also available). Two-axis stability augmentation system with pitch and roll hold. Three- and four-axis AFCS available from late 1994.

STRUCTURE: Rotor blades (main and tail) and single-spar horizontal stabiliser of laminated GFRP impregnated with epoxy resin; tail rotor driveshaft of duralumin tube with splined couplings; duralumin fuselage; GFRP fin trailing-edge.

LANDING GEAR: Non-retractable tricycle type, plus tailskid beneath tailboom. Twin-wheel castoring and self-centring nose unit; single wheel on each main unit. Oleo-pneumatic shock-absorber in each unit. Mainwheel Stomil Poznań tyres size 700x250; nosewheel tyres size 400x140. Tyre pressures 4.90 and 4.40 bar (71 and 64 lb/sq in) respectively. Pneumatic disc brakes on mainwheels. Max ground speed (paved surface) 32 kt (59 km/h; 37 mph). Metal ski landing gear optional. Six inflatable flotation bags on Anakonda and W-3AM.

POWER PLANT: Two WSK PZL-Rzeszów PZL-10W turbo-shafts, each with rating of 671 kW (900 shp) for T-O and emergency ratings of 746 kW (1,000 shp) and 858 kW (1,150 shp) for 30 and 2½ minutes OEI respectively.

Particle separators on engine intakes, and inlet de-icing, standard. Power plant equipped with advanced electronic fuel control system for maintaining rotor speed at pilot-selected value amounting to ± 5 per cent of normal rpm, and also for torque sharing as well as for supervising engine limits during start-up and normal or OEI operation. Engines and main rotor gearbox mounted on bed frame, eliminating drive misalignment due to deformations of fuselage. Transmission rating 1,342 kW (1,800 shp) maximum for T-O, 1,163 kW (1,560 shp) maximum continuous and 857 kW (1,150 shp) OEI. Engine input rpm 23,615.

Four bladder fuel tanks beneath cabin floor, with combined capacity of 1,720 litres (454 US gallons; 378 Imp gallons). Auxiliary tank, capacity 1,100 litres (291 US gallons; 242 Imp gallons), optional (not FAA approved). Oil capacity 14 litres (3.7 US gallons; 3.1 Imp gallons) per engine.

ACCOMMODATION: Pilot (port side), and co-pilot or flight engineer, side by side on W-3 flight deck, on adjustable seats with safety belts. W-3A can be flown by single pilot in VFR, with extra passenger in co-pilot seat. Dual controls and dual flight instrumentation optional. Accommodation for 12 passengers in main cabin or up to eight survivors plus two-person rescue crew and doctor in Anakonda SAR version. Seats removable for carriage of internal cargo. Medevac version can carry four stretcher cases and medical attendant (EMS version, one stretcher, three medical personnel and intensive care suite). Baggage space, capacity 180 kg (397 lb), at rear of cabin.

Door with bulged window on each side of flight deck; large sliding door for passenger and/or cargo loading on port side at forward end of cabin; second sliding door at rear of cabin on starboard side. Optically flat windcreens, improving view and enabling wipers to sweep a large area. Accommodation soundproofed, heated (by engine bleed air) and ventilated.

SYSTEMS: Two independent hydraulic systems, working pressure 100 bar (1,450 lb/sq in), for controlling main and tail rotors, unlocking collective pitch control lever, and feeding damper of directional steering system; automatic power changeover if one system fails. Max flow rate 11 litres (2.9 US gallons; 2.4 Imp gallons)/min in each system. Vented gravity feed reservoir, at atmospheric pressure. Pneumatic system for actuating hydraulic mainwheel brakes. Electrical system providing 200/115 V Three-phase AC power at 400 Hz and 28 V DC power. Electric anti-icing of all rotor blades. Fire detection/extinguishing system. Air conditioning and oxygen systems optional. Neutral gas system optional, for inhibiting fuel vapour explosion.

AVIONICS: Standard VFR and IFR nav/com avionics permit adverse weather operation by day or night. Bendix/King avionics standard; alternatives at customer's option.

Comms: Chrom (NATO 'Pin Head') IFF transponder in military versions.

Radar: Bendix/King RDS-82 weather radar in W-3A; 5A-813 radar in W-3RM; RDR-2000 weather radar in c/n 310801.

Flight: Stability augmentation system standard.

Mission: SPOR search and detection system in W-3RM.

Self-defence: Modified Syrena RWR in military versions initially; to be replaced by Thales EWR-99 (SPS-H in W-3PPD).

EQUIPMENT: Cargo version equipped with 2,100 kg (4,630 lb) capacity external hook and 150 kg (331 lb) capacity rescue hoist. W-3RM has 272 kg (600 lb) capacity electric hoist; stretchers, two-person rescue basket, rescue belts, two six-person liferafts, rope ladder, portable oxygen equipment, electric blankets and vacuum flasks, various types of buoy (light, smoke and radio) and marker, binoculars, flare pistol and searchlights. Firefighting

W-3 SOKÓŁ PRODUCTION
(to 1 January 2006)

Version	Lot 1 1986-89	Lot 2 1989-93	Lot 3 1990-93	Lot 4 1992-98	Lot 5 1994-95	Lot 6 1996-98	Lot 7 1997-98	Lot 8 1999-	Total
W-3	10 ¹	22 ²	17	3 ³				2	52
W-3A			1	4		12			19
W-3PPD							1		1
W-3AM				2		5	6		13
W-3RM			1	6					7
W-3W		1		5	17				23
W-3WA					3	2	10	8	23
W-3WARM							2	1	3
SRR-10						1			1
Unidentified							1		1
Static test		2 ⁴	1						3
Totals	10	25	20	20	20	20	20	11	145

¹ One converted as S-1RR Procion prototype

² One to W-3U¹ prototype; reverted to W-3 before delivery

³ Two upgraded to W-3RL by WZL 1

⁴ Israel Aircraft Industries and Instytut Lotnictwa

W-3 SOKÓŁ CUSTOMERS
(at 1 March 2006)

Country	Customer	Qty	Version	First aircraft	First delivery
Czech Republic	Air Force	11	W-3A	0709	Sep 96
Germany	Saxony Police	2	W-3A	D-HSNA	Mar 94
Iraq	Air Force	2	W-3A	-	due mid-06
Korea, South	Choong Nam Fire Dept	1	W-3A	119	Dec 99
	CitiAir	4	W-3AM	HL-9220	Dec 95
	Daegu Fire Dept	1	W-3AM	?	Nov 01
	Daewoo	1	W-3A	SP-FSU ¹	not delivered
		1	W-3AM	HL-9257	Oct 96
		4	W-3AM	HL-9259	Jul 97
Myanmar	Heli Korea	4	W-3	6501	Nov 90
Nigeria	Air Force	13	W-3	5N-UYI	Dec 91
Poland	Okada Air	1	W-3	0415	Jul 93
	Air Force	7	W-3	0516	Apr 94
		5	W-3W	0618	?
		5	W-3WA	0601	Sep 94
	Army	17	W-3W	0806	97
		18	W-3WA	0806	Feb 97
	Helisecco	2	W-3	SP-SUB	Jul 96
		1	W-3AM	SP-SYI	
	Lublin Medical Aviation Centre	2	W-3	SP-SXU ¹	Feb 94
	Ministry of Defence	1	W-3/S-1RR	0203	96
		1	W-3RR/SRR-10	0720	98
		1	W-3PPD	0816	01
	Ministry of Interior	2	W-3	0315	Apr 90
		1	W-3A	0420	Jun 94
		1	W-3RM	0510	Apr 93
	Navy	2	W-3	0209	Jul 89
		5	W-3RM	0505	Jul 92
		3	W-3WARM	0813	Aug 98
	Polish Telecom	1	W-3	SP-SU1	Apr 92
	PZL Swidnik	1 ²	W-3	SP-SU'A	Jan 89 ¹
		1	W-3W prot	SP-SU'W	Mar 93 ¹
		1	W-3RM prot	0411/SP-SYG	Sep 95 ¹
		1 ³	W-3A2	SP-PSL	May 98 ¹
	Zakopane Mountain Rescue	1	W-3	SP-SXT	Feb 93
		2	W-3A	0507	Jan 96
Russia	Aeroflot	20 ⁴	W-3	SSSR-04101	Aug 88
	Krasnodarski Kray	1	W-3	RA-10801	Jul 03
UAE	Ministry of Internal Affairs	2	W-3A	?	02
Vietnam	SFC Vietnam	1	W-3AM	VN-417	Jan 98
Total		147			

¹ Date of registration

² Firefighting demonstrator

³ Smiths Industries SN-530 four-axis AFCS

⁴ J8 transferred to Helisecco from January 1996

version: one 1,590 litre (420 US gallon; 350 Imp gallon) 'Bambi bucket' on cargo sling or 1,500 litre (396 US gallon; 330 Imp gallon) expandable underbelly tank.

ARMAMENT: As described under Current Versions.

DIMENSIONS, EXTERNAL:

Main rotor diameter	15.70 m (51 ft 6 in)
Tail rotor diameter	3.03 m (9 ft 11½ in)
Main rotor blade chord	0.44 m (1 ft 5¼ in)
Distance between rotor centres	9.50 m (31 ft 2 in)
Length: overall, rotors turning	18.79 m (61 ft 7¾ in)
Fuselage	14.21 m (46 ft 7½ in)
Fuselage max width	1.75 m (5 ft 9 in)
Height: to top of rotor head	4.20 m (13 ft 9½ in)
overall, rotors turning	5.135 m (16 ft 10¼ in)
Stabiliser span	2.385 m (7 ft 10 in)
Wheel track	3.15 m (10 ft 4 in)
Wheelbase	3.55 m (11 ft 7¾ in)
Passenger/cargo doors:	
Height (each)	1.18 m (3 ft 10½ in)
Width: port	0.94 m (3 ft 1 in)
starboard	1.25 m (4 ft 1¼ in)
Height to sill	0.86 m (2 ft 10 in)

DIMENSIONS, INTERNAL:

Cabin: Length	3.21 m (10 ft 6½ in)
Max width	1.55 m (5 ft 1 in)
Max height	1.38 m (4 ft 6¼ in)
Floor area	4.80 m² (51.7 sq ft)
Volume	6.9 m³ (243 cu ft)

AREAS:

Main rotor disc	193.6 m² (2,083.8 sq ft)
Tail rotor disc	7.21 m² (77.6 sq ft)
Main rotor blades (each)	2.90 m² (31.22 sq ft)
Tail rotor blades (each)	0.28 m² (3.01 sq ft)
Fin	1.00 m² (10.76 sq ft)
Elevator	2.16 m² (23.25 sq ft)

WEIGHTS AND LOADINGS:

Min basic weight empty	3,300 kg (7,275 lb)
Basic operating weight empty (multipurpose versions)	3,850 kg (8,488 lb)
Max baggage weight	180 kg (397 lb)
Max fuel weight	1,326 kg (2,923 lb)
Max cargo payload, internal or external	2,100 kg (4,630 lb)
Normal T-O weight	6,100 kg (13,448 lb)
Max T-O weight	6,400 kg (14,110 lb)
Max disc loading	33.1 kg/m² (6.78 lb/sq ft)
Transmission loading at max T-O weight and power	4.77 kg/kW (7.84 lb/shp)

PERFORMANCE (A: at normal T-O weight, B: at max T-O weight, ISA, except where indicated):

Never-exceed speed (VNE):

A, B 140 kt (260 km/h; 161 mph)

Max cruising speed: A 129 kt (238 km/h; 148 mph)

B 127 kt (235 km/h; 146 mph)

Econ cruising speed: A 121 kt (225 km/h; 140 mph)

B 120 kt (222 km/h; 138 mph)

Max rate of climb at S/L: A 558 m (1,831 ft)/min

B 510 m (1,673 ft)/min

Service ceiling: A 4,910 m (16,100 ft)

B 4,520 m (14,820 ft)

Hovering ceiling IGE:

A at ISA 3,020 m (9,900 ft)

B at ISA 2,550 m (8,360 ft)

A at ISA + 20°C 2,150 m (7,050 ft)

B at ISA + 20°C 1,690 m (5,540 ft)

Hovering ceiling OGE:

A at ISA 1,900 m (6,220 ft)

B at ISA 660 m (2,160 ft)

A at ISA + 20°C 1,020 m (3,340 ft)

B at ISA + 20°C 400 m (1,310 ft)

Max range at econ cruising speed, no reserves:

A (standard tanks) 402 n miles (745 km; 463 miles)

B (standard tanks) 396 n miles (734 km; 456 miles)

A (with ferry tank) 622 n miles (1,152 km; 715 miles)

B (with ferry tank) 671 n miles (1,244 km; 773 miles)

Max endurance at 67 kt (125 km/h; 78 mph), no reserves:

A (standard tanks) 4 h 18 min

B (standard tanks) 4 h 12 min

A (with ferry tank) 6 h 42 min

B (with ferry tank) 6 h 24 min

PERFORMANCE (W-3RM at typical mission T-O weight of 5,500 kg; 12,125 lb):

Never-exceed speed (VNE) 140 kt (260 km/h; 161 mph)

Max cruising speed 131 kt (243 km/h; 151 mph)

Max rate of climb at S/L 672 m (2,205 ft)/min

Service ceiling 5,830 m (19,120 ft)

Hovering ceiling: IGE 4,000 m (13,120 ft)

OGE 2,970 m (9,740 ft)

Max range, no reserves 411 n miles (761 km; 473 miles)

Max endurance, no reserves 4 h 20 min

PZL SW-4

TYPE: Light utility helicopter.

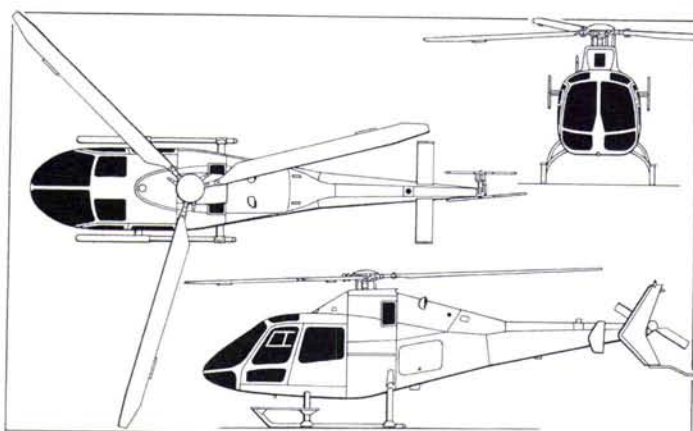
PROGRAMME: Development began 1985; full-scale mockup completed 1987; major redesign undertaken 1989–90, using Allison (now Rolls-Royce) 250 engine in more streamlined fuselage with modified tail unit. Prototype (c/n 600102), rolled out December 1994, is non-flying testbed for ground and equipment tests; '101 is static test airframe, '103 and '104 are flying prototypes. First flight made by 600103 (red overall; later registered SP-PSW) on 26 October 1996 ('official' flight three days later).

Trials in 1997 demonstrated requirement for a new rotor head design, enlarged horizontal stabiliser and more efficient hydraulic system. Following 70 hours of test-flying, SP-PSW was grounded in late 1997 for installation of SAMM-designed hydraulic flight control system, with which it was then due to return to flying in 1998. Second flying prototype (yellow overall), with improved skids, exhibited statically at Paris Air Show, June 1997; registered as SP-PSZ in October 1998, but not flown until early 2001. Some 640 hours (total) flown by July 2002, when certification programme almost complete; domestic



Cockpit of PZL-Świdnik SW-4 light helicopter

1180245



PZL-Świdnik SW-4 (Rolls-Royce 250-C20R/2 turboshaft) (Mike Keep)

1133246



PZL SW-4 of Polish Air Force

1158621

certificate to JAR 27 awarded 14 November 2002. First five production aircraft started in July 2002. Second prototype flown at Paris Air Show in June 2001; first at Berlin in May 2002. First production SW-4 ordered in 20 November 2003 contract; second aircraft ordered later. Polish Air Force accepted first aircraft (0201) on 15 November 2004; first pair scheduled to replace Mi-2s at PAF Academy, Deblin; second aircraft (0202/SP-PSY) is company demonstrator.

Świdnik is considering re-engining SW-4 with 485 kW (650 shp) -C30 version of Rolls-Royce 250 turboshaft.

CUSTOMERS: Polish Air Force requirement confirmed for purchase of 30 by 2010, of which first (serial number 0201) was handed over 15 November 2004 for use in training role. Four of first five production aircraft scheduled for Polish Air Force Academy; fifth is for commercial operation. Four more scheduled for completion in 2007; delivery completion due in 2010.

COSTS: USD950,000 (2006).

DESIGN FEATURES: Intended applications include passenger and cargo transport, VIP, medevac, border patrol, law enforcement, armed scout and training use.

Three-blade main rotor; arrowhead tailfin on port side, with two-blade tail rotor to starboard; narrow tailplane with small endplate fins; skid landing gear.

STRUCTURE: Main structural components of aluminium alloys and glass fibre epoxy. Cabin of foam-filled carbon and glass fibre panels in epoxy matrix; centre-fuselage is stressed box of honeycomb sandwich panels, to which fuel tank and main gearbox are attached. Glass fibre/epoxy main and tail rotor blades.

LANDING GEAR: Skid type; able to accommodate heavy landing sink rate of 3.1 m (10 ft)/s by elastic deflection of cross-tubes.

POWER PLANT: One 336 kW (450 shp) Rolls-Royce 250-C20R/2 turboshaft. Transmission rating 336 kW (450 shp) for T-O, 283 kW (380 shp) maximum continuous; 30 minute run-dry capability. Standard fuel capacity 500 litres (132 US gallons; 110 Imp gallons) in tank below main gearbox.

ACCOMMODATION: One or two pilots plus three or four passengers; or one stretcher patient and a medical attendant. Dual controls can be added for training role. One front-hinged and one rearward-sliding door on each side of cabin. Baggage compartment, capacity 150 kg (331 lb), to rear of cabin, with external access on port side.

AVIONICS: *Instrumentation:* Bendix/King or Garmin VFR standard, IFR optional. Latter include VSI, altitude indicator, gyro-compass, ADF, ICS, 155XL GPS, VHF/AM, VOR/LOC/GS, radar, altimeter, transponder, encoder and clock.

EQUIPMENT: In law enforcement role, can be equipped with thermal imaging and TV cameras, searchlight, loudspeaker, special intercom and radio, and external hoist. For military roles, can be fitted with external support bars for up to 440 lb (970 lb) of specialist equipment.

Military training version available with extended instrument panel, hydraulically powered dual controls, crashworthy seats, flight data recorder, emergency situation switch unit (ESSU; provides simulated failures of hydraulic system, attitude indicator and gyro-compass) and NVG equipment.

DIMENSIONS, EXTERNAL:

Main rotor diameter	9.00 m (29 ft 6 1/4 in)
Tail rotor diameter	1.50 m (4 ft 11 in)
Distance between rotor centres	5.25 m (17 ft 2 3/4 in)
Length:	
overall, both rotors turning	10.55 m (34 ft 7 1/2 in)
fuselage; incl tailskid	9.075 m (29 ft 9 3/4 in)
excl tailskid	8.25 m (27 ft 0 3/4 in)
Max width: cabin	1.515 m (4 ft 11 3/4 in)
over tail unit endplates	1.83 m (6 ft 0 in)
over skids	2.28 m (7 ft 5 3/4 in)
Height to top of rotor head	3.13 m (10 ft 3 3/4 in)
Skid track	2.28 m (7 ft 5 3/4 in)
Fuselage ground clearance	0.55 m (1 ft 9 3/4 in)
Sliding door:	
Width: at top	0.82 m (2 ft 8 1/4 in)
at bottom	1.08 m (3 ft 6 1/2 in)
Max height	1.25 m (4 ft 1 1/4 in)
Baggage door: Max width	0.81 m (2 ft 8 in)
Max height	0.535 m (1 ft 9 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	2.14 m (7 ft 0 1/4 in)
Max width	1.41 m (4 ft 7 1/2 in)

Max height	1.27 m (4 ft 2 in)
Volume	3.85 m ³ (136 cu ft)
Baggage compartment: Length	1.475 m (4 ft 10 in)
Height: at front	0.89 m (2 ft 11 in)
at rear	0.535 m (1 ft 9 in)
Volume	0.85 m ³ (30.0 cu ft)
AREAS:	
Main rotor disc	63.62 m ² (684.8 sq ft)
Tail rotor disc	1.77 m ² (19.05 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	1,050 kg (2,315 lb)
Max payload: internal	473 kg (1,043 lb) ¹
on external sling	550 kg (1,213 lb)
Max T-O weight	1,800 kg (3,968 lb)
Max disc loading	26.7 kg/m ² (5.47 lb/sq ft)
Transmission loading at max T-O weight and power	5.07 kg/kW (8.33 lb/shp)

¹ 323 kg (712 lb) in main cabin, 150 kg (331 lb) in baggage compartment

PERFORMANCE (A: at 1,600 kg; 3,527 lb AUW, ISA, B: at 1,800 kg; 3,968 lb):

Never-exceed speed (VNE):	140 kt (260 km/h; 161 mph)
Cruising speed:	
A, B	113 kt (209 km/h; 130 mph)
Econ cruising speed:	
A	102 kt (188 km/h; 117 mph)
B	103 kt (190 km/h; 118 mph)
Max rate of climb at S/L: A	628 m (2,060 ft)/min
B	494 m (1,620 ft)/min
Service ceiling: A	5,200 m (17,060 ft)
B	4,200 m (13,780 ft)
Hovering ceiling IGE:	
A	3,300 m (10,825 ft)
B	2,150 m (7,050 ft)
Hovering ceiling OGE:	
A	2,200 m (7,220 ft)
B	910 m (2,980 ft)
Range with max standard fuel, no reserves:	
A	426 n miles (790 km; 490 miles)
B	409 n miles (758 km; 471 miles)
Max endurance: A	5 h 35 min
B	5 h 12 min

SSH

SERWIS SAMOLOTOW HISTORYCZNYCH-JANUSZ KARASIEWICZ (JANUSZ KARASIEWICZ HISTORIC AIRCRAFT SERVICE)

Jasienica 829c, Jasienica PL-43 385

Tel: (+48 33) 815 34 91

Fax: (+48 33) 815 34 92

CUSTOMER SERVICE MANAGER: Jolanta Karasiewicz

GERMAN DISTRIBUTOR:

Bücker Flugzeughandels GmbH, Langwiederstrasse 1, D-85757 Karlsfeld-Gröbenried

Tel: (+49 8131) 789 26

Fax: (+49 8131) 803 14

e-mail: mail@bueckerflug.de

Web: www.bueckerflug.de

SSH is certified by the Polish Aviation Authority as an approved production organisation under JAR 21, Subpart G.

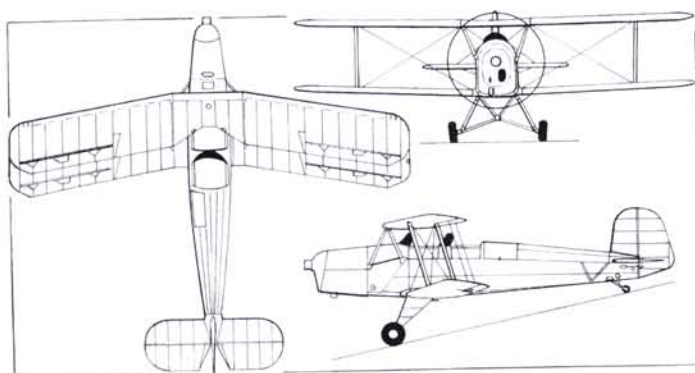
Founder, Janusz Karasiewicz was killed when the B&F FK 12 Comet in which he was a passenger crashed on 26 August 2006. Continued operation of the company is in doubt.

SSH (BÜCKER) T-131 JUNGMAHN

TYPE: Aerobatic two-seat biplane.

PROGRAMME: Original German design first flew 27 April 1934; civil certification 3 October 1938; name ('young man') refers to naval cadet; in addition to some 3,000 by parent firm (ending March 1941), licensed manufacture undertaken in Japan (339 K9W floatplanes and 1,037 Ki-86As), Spain (555 CASA 1.131s), Czechoslovakia (10 Tatra 131s and 300 Bü 131s, plus 260 Aero C.104s after 1945) and Switzerland (130 by Dornier). Last of some 5,700 were those produced in Spain, 1960.

SSH T-131 launched in March 1990, based on engineering drawings of Czech Bü 131D version (T and P in designations indicate Tatra and Poland). First of four pre-series aircraft flew 8 July 1994; first production aircraft exported to Austria in kit form December 1994 and made maiden flight 7 June 1997.



SSH T-131PA Jungmann (James Goulding)

1158553

CURRENT VERSIONS: **T-131P:** Early version, with 78.3 kW (105 hp) Walter Minor 4-III four-cylinder inverted in-line engine and Hoffmann HO-40AHM-180 two-blade fixed-pitch metal propeller. Production complete.

T-131PA: More powerful version, with 103 kW (138 hp) LOM M 332AK four-cylinder, in-line engine. Prototype (SP-FPY) first flew 9 August 1995. Current baseline version; Polish certification under way in 2001 (latest information received), as step towards main objective of full standard certification in Germany.

Description applies to T-131PA.

CUSTOMERS: Three (including prototype) T-131Ps built 1994-95, of which two exported to Sweden. At least 25 T-131PAs registered by mid-2006, including five in Austria; at least 10 to German owners, but retaining Polish registrations, three in Poland and one each to Brazil, Czech Republic, Netherlands and Switzerland. Total 23 production aircraft and three kit versions completed and flown by April 2005.

COSTS: Development EUR70,000 to EUR80,000 (2004). Flyaway EUR103,000; kit (standard or fast-build) EUR51,500 (2005).

DESIGN FEATURES: Single-bay biplane with interchangeable upper and lower wings, braced by pair of I-struts each side. This version based on Bü 131D, with ball bearings in control pivots and tailwheel, although Hirth 504A-2 engine replaced.

Wings have Göttingen aerofoil section (thickness/chord ratio 10.5 per cent) and 11° leading-edge sweepback; dihedral 3° 30' (upper), 1° 30' (lower); incidence -1° 30'; twist -1° 30'.

FLYING CONTROLS: Conventional and manual. Mass-balanced ailerons on all four wings; non-balanced rudder; trim tab in each elevator. No flaps.

STRUCTURE: Welded 4130 chromoly steel tube fuselage and tail unit; wooden wing spars (two) and ribs. Mostly Ceeconite fabric covering except for metal engine cowling and around cockpit area. Fuel tank of glass fibre and carbon fibre.

LANDING GEAR: Tailwheel type; fixed. Two forward-raked, faired-in side Vs, each with oleo-pneumatic shock absorber in forward element, hinged to lower longerons, plus half-axes attached to compression frame; sprung 200x50 tailwheel; mainwheels 420x150. Tyre pressures: main 1.50 bar (53 lb/sq in), tail 2.50 bar (88 lb/sq in). Hydraulic brakes.

POWER PLANT: One 104 kW (140 hp) LOM M 332AK four-cylinder in-line engine, driving an MT32.110/12 two-blade fixed-pitch wooden propeller. Fuselage fuel tank, capacity 85 litres (22.5 US gallons; 18.7 Imp gallons), of which 80 litres (21.1 US gallons; 17.6 Imp gallons) are usable. Oil capacity 8.5 litres (2.25 US gallons; 1.9 Imp gallons).

ACCOMMODATION: Two persons in tandem, open cockpits.

SYSTEMS: 24 V DC electrical system (generator and two batteries).

AVIONICS: Basic VFR standard; other avionics to customer's requirements.

DIMENSIONS, EXTERNAL:

Wing span	7.40 m (24 ft 3 3/4 in)
Wing chord (each, constant)	1.00 m (3 ft 3 3/4 in)
Wing aspect ratio	4.1
Length overall	6.62 m (21 ft 8 1/2 in)
Height overall	2.25 m (7 ft 4 1/2 in)
Tailplane span	2.50 m (8 ft 2 1/2 in)
Wheel track	1.75 m (5 ft 9 in)
Wheelbase	4.10 m (13 ft 5 1/2 in)
Propeller diameter	1.88 m (6 ft 2 in)
Propeller ground clearance	0.63 m (2 ft 0 3/4 in)

AREAS:

Wings, gross	13.50 m ² (145.3 sq ft)
Ailerons (four, total)	2.00 m ² (21.53 sq ft)
Fin	0.50 m ² (5.38 sq ft)
Rudder	0.80 m ² (8.61 sq ft)
Tailplane	1.25 m ² (13.45 sq ft)
Elevators (total, incl tabs)	1.15 m ² (12.38 sq ft)



SSH T-131PA Bücker Jungmann (Paul Jackson)

1158596

WEIGHTS AND LOADINGS (approx):

Weight empty	470 kg (1,036 lb)
Fuel weight	63 kg (139 lb)
Max T-O and landing weight: Normal	720 kg (1,587 lb)
Utility	670 kg (1,477 lb)
Aerobatic	590 kg (1,300 lb)
Max wing loading	53.3 kg/m ² (10.92 lb/sq ft)
Max power loading	6.90 kg/kW (11.33 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	151 kt (280 km/h; 174 mph)
Max level speed	102 kt (190 km/h; 118 mph)
Max cruising speed at S/L	97 kt (180 km/h; 112 mph)
Econ cruising speed at S/L	86 kt (160 km/h; 99 mph)
Stalling speed, engine idling	46 kt (85 km/h; 53 mph)
Max rate of climb at S/L	210 m (689 ft)/min
Service ceiling	4,000 m (13,120 ft)
T-O run	180 m (590 ft)
T-O to 15 m (50 ft)	400 m (1,315 ft)
Landing from 15 m (50 ft)	300 m (985 ft)
Landing run	150 m (495 ft)
Max range, 30 min reserves	283 n miles (525 km; 326 miles)



First SSH-built Jungmeister before covering and re-engining (Paul Jackson)

0110937

SSH (BÜCKER) Bü-133P JUNGMEISTER

English name: Young Champion

TYPE: Aerobatic single-seat biplane.

PROGRAMME: Entered service in 1936; also licence-built in Spain and Switzerland. Small number of replicas built in late 1960s by Bitz at Augsburg and Hirth at Nabern. SSH project initiated in late 1990s; prototype (SP-PUV) planned to fly in second quarter 2004 but not reported by mid-2006, although new registration (SP-YBK) reserved in mid-2005. Perpetuates original German Bü 133C of 1935 except for replacement of the original's 119 kW (160 hp) Hirth 506 engine. (Correct German designation is unhyphenated.)

DESIGN FEATURES: Generally similar to those of Jungmann.

FLYING CONTROLS: As Jungmann.

STRUCTURE: Fabric-covered steel tube fuselage and tail unit, except for wooden turtledeck; two-spar wooden wings with composites leading-edges and metal interplane struts.

LANDING GEAR: Tailwheel type; fixed. Mainwheel tyres size 6,00-6.

POWER PLANT: One 160 kW (215 hp) LOM M 337AK six-cylinder inline engine and MT two-blade variable-pitch propeller.

ACCOMMODATION: Pilot only, in open cockpit.

DIMENSIONS, EXTERNAL:

Wing span	6.60 m (21 ft 7¾ in)
Length overall	6.02 m (19 ft 9 in)
Height overall	2.20 m (7 ft 2½ in)

AREAS:

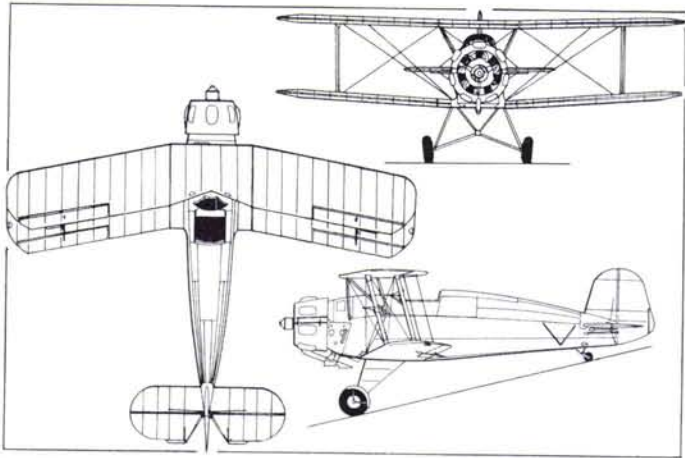
Wings, gross	12.00 m ² (129.2 sq ft)
--------------------	------------------------------------

WEIGHTS AND LOADINGS:

Weight empty	450 kg (992 lb)
Max T-O weight	600 kg (1,322 lb)
Max wing loading	50.0 kg/m ² (10.24 lb/sq ft)
Max power loading	3.74 kg/kW (6.15 lb/hp)

PERFORMANCE (estimated):

Max level speed	216 kt (400 km/h; 248 mph)
Cruising speed	145 kt (270 km/h; 167 mph)



SSH (Bücker) Bü-133P Jungmeister as initially intended

1158552

Time to 1,000 m (3,280 ft)	1 min
Service ceiling	7,000 m (22,965 ft)
Range	324 n miles (600 km; 372 miles)

Romania

AEROSTAR

SC AEROSTAR SA

9 Condorilor Street, R-600302 Bacău
Tel: (+40 234) 57 50 70
Fax: (+40 234) 57 20 23 and 57 22 59
e-mail: aerostar@aerostar.ro

Web: www.aerostar.ro

PRESIDENT AND GENERAL DIRECTOR: Dipl Eng Grigore Filip

DIRECTORS:

Dipl Eng Ovidiu Buhai (Systems Division)
Dipl Eng Dorin Panfil (Industrial Products Division)
Dipl Eng Theodor Placinta (Technological Division)
Dipl Eng Serban Iosipescu (Aeronautical Products Division)
PUBLIC RELATIONS AND MARKETING: Doina-Gabriela Matanie

US DISTRIBUTOR:

Bushwhacker Air
PO Box 68, Corinth, New York 12822
Tel: (+1 518) 796 07 32
e-mail: info@bushwhackerair.com
Web: www.bushwhacker.com

Factory celebrated 50th anniversary in 2003, having been founded 17 April 1953 as URA (later IARAv, then IAv Bacău), originally as repair centre for Romanian Air Force Yak-17/23, MiG-15/17/19/21 and Il-28/H-5 front-line military aircraft and Aero L-29/L-39 jet trainers; built first Romanian prototype of IAR-93 between 1972 and 1974. As of April 2006, Aerostar industrial group was organised in five divisions: Systems, Aeronautical Products, Special Products, Technological and Logistics. Main lines of business are: manufacture of aircraft and aerostructures; production of hydraulic and pneumatic equipment, landing gears and aviation spare parts; maintenance, overhaul and upgrade of aircraft and aero-engines; electronic systems and equipment; ground defence systems; and supply of integrated logistic support. Site area 45 ha (111.2 acres), including 25 ha (61.8 acres) of covered workshop space. Workforce 1,735 in April 2006.

Romanian State Ownership Fund (SOF) originally owned 69.99 per cent of Aerostar. In preparation for full privatisation, Aerostar reorganised 1997 into three semi-autonomous divisions: systems, commercial, and technology support, reporting to a strategic fourth division. Creation of a joint venture (Aerothom Electronics) with Thomson-CSF (now Thales) Communications announced June 1999; Aerostar owns 60 per cent of this company, formed to supply IFF equipment to Romanian MoD. Aerostar became fully privatised company 11 February 2000 as part of Aerostar-PAS-IAROM, a consortium of Aerostar management and employees (PAS) with IAROM, acquiring Aerostar stock previously held by SOF. The current shareholdings are IAROM 71.09 per cent; SIF 'Moldova' (financial investment company) 11.14 per cent; others 17.77 per cent. In 2003, SOF renounced the 'golden share' entitling it to veto matters affecting company's defence production capability, following harmonisation with EU regulations. Consortium agreed to take over all Aerostar's obligations and debts; not to dissolve company for 10 years; and to keep its core business intact for at least five years. Company turnover in 2005 was RON102.7 million, of which exports accounted for more than 34 per cent. Net profit for the year was RON6.8 million.

Aerostar's main product for many years has been Iak-52 trainer, joined in 2001 by Festival, Manufactures airframes for German ULBI Wild Thing ultralight (more than 80 in decade 1994 to 2003) and components for Flug Werk replicas of Focke-Wulf Fw 190. North American P-51 Mustang replica available 2003 from Fighter Factory LLC, 13545 Sycamore Avenue, San Martin, California 95046, USA (tel: +1 408 683 25 31; fax: +1 408 683 25 33). Responsible for Lancer and Sniper Romanian Air Force upgrade programmes for, respectively, MiG-21s (completed April 2003) and MiG-29s. Also performing MRO and upgrades of Aero L-39ZA.

Landing gears and/or hydraulic/pneumatic equipment have been produced for IAR-316B (Alouette III), IAR-330 (Puma), IAR-93, IAR-99, Romaero (BAC) One-Eleven and Iak-52. From 2003, producing sheet metal for Stork-Fokker Aerospace contribution to manufacture of components for Airbus and Cessna. Engines include M-14P for Iak-52, M-14V26 for Ka-26 and RU-19A-300 APU for An-24; reduction gears include R-26. Avionics factory produces radio altimeters, radio compasses, marker beacon receivers, IFF and other radio/radar items.

AEROSTAR (YAKOVLEV) Iak-52

TYPE: Primary prop trainer/sportplane.

PROGRAMME: Design of Yak-52 in USSR began 1975; series production assigned to Comecon programme (Council for Mutual Economic Assistance), following Romanian-USSR intergovernmental agreement of 1974; designation is transliteration of 'Yak' in Romanian alphabet, but civil aircraft are registered as Yaks.

Construction began 1977 and first Romanian prototype (c/n 780102) made first flight May 1978; series production began 1979; first deliveries (to DOSAAF, USSR) 1975; 1,000th aircraft delivered in 1986 and 1,500th in 1990. After cessation of deliveries to USSR in 1991, production had almost come to a standstill, but interest reawakened by improved Iak-52W (first flight April 1999, debut at Paris Air Show, June 1999). Iak-52W began development 1998 and first flew (12201) March 1999; currently offered as alternative to standard version, but no recent production known. Aerostar planned five-year programme of 30 per year; deliveries started August 1999. Tailwheel (TW) version announced early 2000; first flew ('26', c/n 0112226, later N52SD1) 2 July 2001; launched at EAA AirVenture, Oshkosh, 24 to 30 July 2001; is now the only Romanian production version.

CURRENT VERSIONS: **Iak-52TW:** New-build tailwheel version of Iak-52W, revealed early 2000. Production aircraft available from July 2001 (four sold by end of first day of promotion at Oshkosh); US marketing by GeoCo Industries of Swanton, Vermont, USA. Features include mainwheel legs mounted farther forward, extended (rounded) wingtips, uprated engine with underslung oil radiator and modified front shutters; each cockpit lengthened by 10 cm (4 in).

Detailed description applies to this version.

CUSTOMERS: Following some 1,815 Iak/Yak-52s, Iak-52W/TW production began with 122nd batch; total 12 Iak-52Ws (including prototype) built 1999-late 2000. Deliveries have included at least nine to USA and one to Australia.

Iak-52TW deliveries began in mid-2001; some 34 built by mid-2005; most to US but four to Australia; none known in following 12 months to mid-2006.

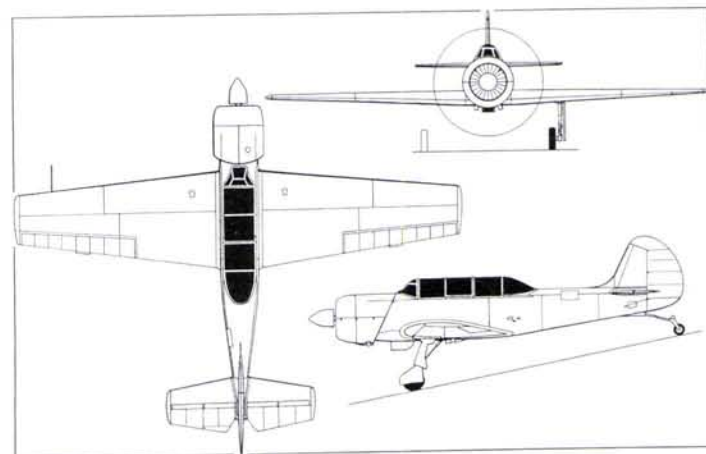
COSTS: Standard Iak-52TW USD150,000 (2003).

DESIGN FEATURES: Tandem-cockpit variant of Yak-50, with unchanged span and length, but with mainwheels fully retractable. Simple, robust, low-wing design with long landing gear



Aerostar (Yakovlev) Iak-52TW (Paul Jackson)

1158583



Aerostar (Yakovlev) Iak-52TW primary prop trainer and sportplane (Dennis Punnett)

1127527

legs to accommodate large propeller. Moderately tapered wings and tailplane; curved fin: 'glasshouse' canopy. Current production aircraft lack wingtip fairings. Strengthened wingtips for optional fitment of tip-tanks. Increased wing span compared with earlier versions.

Wing section Clark YH; thickness/chord ratio 14.5 per cent at root, 9 per cent at tip. Dihedral 2° from root; incidence 2°. Tailplane 0° dihedral, 1° 30' incidence.

FLYING CONTROLS: Conventional and manual. Actuation of mass-balanced slotted ailerons by pushrods; mass-balanced elevators by pushrods/cables; and horn-balanced rudder by cables; manually operated trim tab in port elevator; ground-adjustable tab on rudder and each aileron. Pneumatically actuated trailing-edge split flaps.

STRUCTURE: All-metal, including primary control surfaces. Single-spar wings; modified spar, post-1986 (and some retrofits), permits higher load factors. Wingtips strengthened, enabling tip-tanks to be carried (not a factory configuration). Airframe life 5,000 hours.

LANDING GEAR: Tailwheel type; single wheel and oleo-pneumatic shock-absorber on each retractable main unit. Mainwheels (size 6.00-6) fully retractable, on Aerostar pneumatically actuated legs, retracting inward; flush doors. Cleveland wheels and Western tyres; fixed Scott steerable tailwheel, with 10x3.50-4 tyre.

POWER PLANT: One 298 kW (400 hp) Aerostar-built VOKBM (Bakanov) M-14P-XDK nine-cylinder air-cooled radial, driving a three-blade constant-speed MT-Propeller MTV-9-B-C/CL250-27 propeller. Two aluminium alloy fuel tanks, in wingroots forward of spar; collector tank in fuselage supplies engine during inverted flight.

Total internal fuel capacity 280 litres (74.0 US gallons; 61.6 Imp gallons). Oil capacity 10 litres (2.6 US gallons; 2.2 Imp gallons).

ACCOMMODATION: Tandem seats for pupil (at front) and instructor under long 'glasshouse' canopy, with separate rearward-sliding hood over each seat. Hooker Harness seat belts for both occupants. Dual controls standard. Seats and rudder pedals adjustable. Heating and ventilation standard. Externally accessible baggage and battery compartments on port side, aft of rear cockpit, plus permanently mounted retractable ladder for cockpit access.

SYSTEMS: Independent main and emergency pneumatic systems, pressure 50 bar (725 lb/sq in), for flap and landing gear actuation, engine starting and brake control. Electrical system (27 V DC) supplied by 3 kW engine-driven generator and two 27 V 23 Ah ASAM batteries; two static inverters in fuselage for 36 V AC power at 400 Hz. Oxygen system available optionally.

AVIONICS: Comms: Western instruments including Garmin IC-AQ200 com radio and GTX transponder, AmeriKing ELT and altitude encoder, and NAT AA80-20 intercom.

Flight: ARK-15M automatic radio compass, eight-channel ADF and GMK-1A gyrocompass.

Other avionics available at customer's option.

EQUIPMENT: Strobe and navigation lights, recessed landing and taxiing lights; roll bar.

DIMENSIONS, EXTERNAL:

Wing span	9.90 m (32 ft 5 3/4 in)
Wing chord: at root	2.10 m (6 ft 10 3/4 in)
mean aerodynamic	1.64 m (5 ft 4 1/2 in)
at tip	1.08 m (3 ft 6 1/2 in)
Wing aspect ratio	6.4
Length overall	7.98 m (26 ft 2 1/4 in)
Height overall, propeller turning	2.70 m (8 ft 10 3/4 in)
Wheel track	2.70 m (8 ft 10 3/4 in)
Propeller diameter	2.40 m (7 ft 10 1/2 in)

DIMENSIONS, INTERNAL:

Cockpit: Max width	0.74 m (2 ft 5 1/4 in)
Max height	1.12 m (3 ft 8 in)

AREAS:

Wings, gross	15.42 m ² (166.0 sq ft)
Ailerons (total)	1.98 m ² (21.31 sq ft)
Flaps (total)	1.03 m ² (11.09 sq ft)



Aerostar lak-52TW in US ownership (Paul Jackson)

Fin	0.61 m ² (6.57 sq ft)
Rudder	0.87 m ² (9.36 sq ft)
Tailplane	1.32 m ² (14.21 sq ft)
Elevators (total)	1.53 m ² (16.47 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped	980 kg (2,160 lb)
Max T-O weight	1,320 kg (2,910 lb)
Max wing loading	85.6 kg/m ² (17.53 lb/sq ft)
Max power loading	4.43 kg/kW (7.27 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	226 kt (420 km/h; 261 mph)
Max level speed: at S/L	162 kt (300 km/h; 186 mph)
at 1,000 m (3,280 ft)	172 kt (320 km/h; 198 mph)
Stalling speed, flaps down	46 kt (85 km/h; 53 mph)
Max rate of climb at S/L	360 m (1,181 ft)/min
Service ceiling	4,000 m (13,120 ft)
T-O run	140 m (460 ft)
Landing run	270 m (885 ft)
Range with max fuel at 500 m (1,640 ft) at cruising speed, 20 min reserves	540 n miles (1,000 km; 621 miles)
g limits	+7/-5



Aerostar R40S Festival employed as a US demonstrator (Paul Jackson)

DIMENSIONS, EXTERNAL:	
Wing span	9.17 m (30 ft 1 in)
Wing mean aerodynamic chord	1.525 m (5 ft 0 in)
Length overall: standard	6.74 m (22 ft 1 1/4 in)
LSA	6.46 m (21 ft 2 1/4 in)
Height overall: standard	2.47 m (8 ft 1 1/4 in)
LSA	2.31 m (7 ft 7 in)
Propeller diameter: standard	1.50 m (4 ft 11 in)
LSA	1.70 m (5 ft 7 in)
DIMENSIONS, INTERNAL:	
Cockpit max width	1.07 m (3 ft 6 in)
AREAS:	
Wings, gross	13.97 m ² (150.4 sq ft)
WEIGHTS AND LOADINGS (A: Jabiru 2200/Rotax 912 UL; B: Rotax 912 ULS; C: LSA):	
Weight empty: A	351 kg (774 lb)
B	354 kg (780 lb)
C	400 kg (882 lb)
Max T-O weight: A, B	535 kg (1,179 lb)
C	598 kg (1,320 lb)
Max wing loading: A, B	38.30 kg/m ² (7.84 lb/sq ft)
C	42.85 kg/m ² (8.78 lb/sq ft)
Max power loading: A	8.96 kg/kW (14.72 lb/hp)
B	7.28 kg/kW (11.96 lb/hp)
C	8.15 kg/kW (13.39 lb/hp)
PERFORMANCE (A, B and C as above):	
Never-exceed speed (VNE):	
A, B, C	116 kt (215 km/h; 133 mph)
Max level speed: A	99 kt (185 km/h; 115 mph)
B	105 kt (195 km/h; 121 mph)
C	101 kt (187 km/h; 116 mph) IAS
Cruising speed: A	92 kt (170 km/h; 106 mph)
B	94 kt (175 km/h; 109 mph)
Stalling speed, flaps down: A	36 kt (66 km/h; 41 mph)
B, C	39 kt (71 km/h; 45 mph)
Max rate of climb at S/L: A	240 m (787 ft)/min
B	330 m (1,083 ft)/min
C	229 m (750 ft)/min
Service ceiling: A, B	4,000 m (13,120 ft)
C	3,500 m (11,500 ft)
T-O run: A	85 m (280 ft)
B	80 m (265 ft)
C	130 m (427 ft)
Landing run: A, B	90 m (295 ft)
C	160 m (525 ft)
Range with max fuel, 20 min reserves:	
A, C	432 n miles (800 km; 497 miles)
B	405 n miles (750 km; 466 miles)
g limits: A, B	+4/-2 (max)
	+6/-4 (ultimate)

AEROSTAR FESTIVAL

TYPE: Side-by-side ultralight; two-seat lightplane.

PROGRAMME: Illustrated (as project) in 1999 company brochure, but no details then given. Made debut (as Aerostar 01) at Paris Air Show, June 2001, following first flight (YR-6138) on 31 May. Certification programme flown between 5 November 2001 and 9 February 2002, resulting in award of domestic certificate April 2002. Aircraft named Festival later that year. Improved design (see Design Features below) introduced 2003, first example (YR-6107) making maiden flight in September; also now certified by Romanian Airclub. Aircraft certified 12 July 2004 as Advanced Ultralight in Canada and (with designation R40S) as Light Sport Aircraft (LSA) on 14 September 2005 in US.

CUSTOMERS: Initial orders received at time of debut (four for Romanian Airclub); planned eventual worldwide sales and output of 40 to 50 per year. First two production aircraft registered in USA (N1062N and N1062M) in July 2001; further four to US by early 2006, at least four flying with private customers in Romania in addition to prototypes.

COSTS: USD55,000 as LSA in US; USD40,000 as advanced ultralight in Canada; USD45,000 in Australia (all 2004).

DESIGN FEATURES: Designed to Canadian standard DS10141E; derivative of ULB1 Wild Thing (see under Germany), originally utilising wings, nose, rear fuselage and tail unit from that aircraft. Principal differences are enlarged cabin, nosewheel landing gear, and relocation of wing in low-mounted position, without strut bracing, but still foldable alongside fuselage for transportation and storage. Horizontal tail also foldable. Subsequently improved with much-revised cockpit layout, upward-opening single-piece canopy and optional three-blade propeller.

Wing aerofoil section NACA 4415.

FLYING CONTROLS: Conventional and manual. Flaps and Frise-type ailerons pushrod-actuated, elevators and horn-balanced rudder by cables; mechanically or electrically actuated elevator trim tab. Flap settings 0, 15 and 30°. Dual controls standard.

STRUCTURE: Aluminium alloy (6061), except for fabric-covered (aluminium in US) flaps and ailerons. Three-spar wings, Flush-riveted wing skins from YR 5050 (first flight October 2005).

LANDING GEAR: Tricycle type, fixed. Fuselage-mounted spring cantilever mainwheel legs, Mateco hydraulic disc brakes and 5.00-5 tyres; steerable, trailing-link nosewheel with 5.00-5 tyre and rubber shock absorption.

POWER PLANT: One 59.6 kW (79.9 hp) Rotax 912 UL engine standard, driving a three-blade adjustable-pitch wooden propeller. Options include 59.7 kW (80 hp) Jabiru 2200 or 73.5 kW (98.6 hp) Rotax 912 ULS with two- or three-blade, ground-adjustable pitch propeller. Rotax 912 S or ULS and three-blade propeller in LSA version.

Fuel tank capacity (two wing tanks) 80 litres (21.1 US gallons; 17.6 Imp gallons). Oil capacity 2.5 litres (0.7 US gallon; 0.55 Imp gallon).

ACCOMMODATION: One-piece upward-opening canopy. Baggage compartment aft of seats.

AVIONICS: Basic VFR instrumentation (ASI, altimeter, variometer, turn-and-slip indicator and compass) standard; Bendix/King KY 92 radio optional.

AVIOANE

AVIOANE CRAIOVA SA

10 Aviatorilor Street, Judetul Dolj, R-207280 Ghercești, Craiova
Tel: (+40 251) 40 29 01
Fax: (+40 251) 40 20 40
e-mail: avioane@acv.ro
Web: www.acv.ro
MANAGING DIRECTOR: Pantelimon Vilceanu
OPERATIONAL DIRECTOR: Dumitru Saiu
HEAD OF BUSINESS DEVELOPMENT: Valentin Bernovschi
MARKETING MANAGER: Marius Cosma

Founded 1 February 1972 as Intreprinderea de Avioane Craiova, beginning aircraft manufacture with joint Romanian/Yugoslav IAR-93/Orao attack aircraft; changed to present name 17 December 2001; range of products and services for military and civil aviation includes equipment and parts manufacture for Stork-Fokker and SABCA. Aircraft and equipment design and manufacture, repair and overhaul, life cycle management and integrated logistics support. Granted ISO 9001 status 1998. Site area 1.70 ha (4.20 acres), including 47,500 m² (511,275 sq ft) shop floor area. Workforce had dwindled from 1,300 in April 2002 to about 870 by mid-2004. At that time, privatisation of the company was expected to begin in the following September, after transfer of 40 per cent of its assets to the Dolj County Administration Authority to repay earlier debts. However, by mid-2006 company still 99.95 per cent Romanian-owned, including 91.45 per cent by Ministry of Industry and Resources.

Company turnover was EUR5.5 million in 2005. Workforce had decreased to about 700 by mid-2006.

AVIOANE IAR-99 ȘOIM

English name: Hawk

TYPE: Advanced jet trainer/light attack jet.

PROGRAMME: Design by Institutul de Aviatie at Bucharest started 1975; three prototypes, of which S-001 made first flight 21 December 1985; S-003 second flying prototype. Initial production batch of 17 (serial numbers 701-717), deliveries of which began 1988; two of these (708 and 709) completed for proposed avionics upgrade programme with Jaffe Aircraft of USA in 1991, which not pursued; one (712) equipped with Collins avionics in 1992; similar venture with IAI resulted in upgraded IAR-109 Swift prototype (7003, converted S-003), flown in November 1993, but no production of this version ensued.

Requirement for 24 new aircraft with Elbit modernised avionics announced in September 1998 and received Romanian MoD approval in 2000, following first flight of prototype (serial number 718) on 22 May 1997. First upgraded aircraft (718; actually constructed 1994) served as development demonstrator. Four (serials 719 to 722) ordered September 2001; deliveries began with 719, which was rolled out on 31 July 2002 and handed over 1 August, and were completed in February 2003. Defence cuts subsequently reduced new-build order, although some earlier aircraft will be upgraded to new standard. Latest contract, announced 10 November 2004 and valued at USD43 million, calls for three more new-build IAR-99Cs and Elbit Systems upgrade of five Standard IAR-99s, to be completed by mid-2008. First of this Lot 2 batch rolled out 26 April 2006.

CURRENT VERSIONS: **Standard IAR-99:** Initial production version (17) for Romanian Air Force; in service with 67th Fighter-Bomber Group at Craiova.

IAR-99C: Elbit (Israel) teamed with Avioane to produce this version as lead-in fighter trainer for Romanian Air Force and to offer for export. USD21 million contract for 24 aircraft announced in September 1998 and contained options for further 16 to follow. Order reduced in September 2001 to four, of which first two (719 and 720) flown in August and October 2002; 721 and 722 had followed by February 2003, but 721 lost in landing accident on 22 September 2004. Further three ordered in November 2004.

Following description applies to this version.

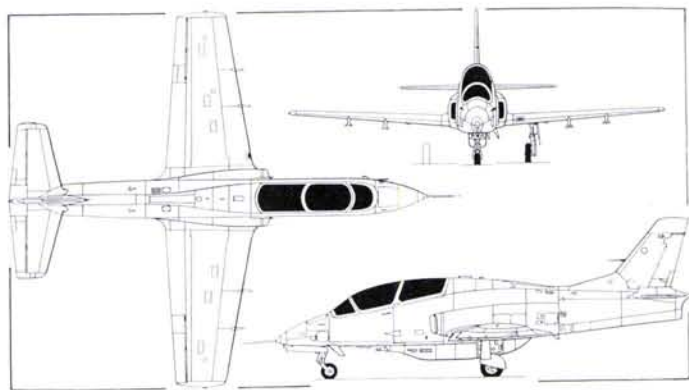
CUSTOMERS: Total of 17 of original production version delivered to Romanian Air Force, of which about 13 remain, although eight reported to be in store in late 2004, awaiting overhaul and/or upgrading. Deliveries of four IAR-99Cs (719 to 722) as lead-in fighter trainers (LIFT) for RomAF MiG-21 Lancer completed February 2003.

COSTS: IAR-99C approximately USD6 million (2002).

DESIGN FEATURES: Typical basic/advanced jet trainer with tandem, stepped cockpits and moderately tapered wings. Provision for armament increases versatility.

Wing section NACA 64₁A-214 (modified) at centreline; 64₁A-212 (modified) at tip; dihedral 3° from roots; quarter-chord sweepback 6° 35'; incidence 1° at root. Tail unit sweepback at quarter-chord 34° on fin, 9° 8' on tailplane.

Main feature of Elbit avionics suite is a data transfer system that processes navigational information received via datalink from other aircraft or from a ground station equipped with the same system. This information is presented on a simulated 'virtual radar' display in the



Antenna detail identifies the current IAR-99C Șoim (Dennis Punnett)

0079327

front cockpit, so that the pilot can be trained in the use of radar without a need for the IAR-99 itself to be fitted with a radar. IAR-99C can be identified by large blade antenna beneath nose on port side.

FLYING CONTROLS: Conventional and partly assisted. Statically balanced ailerons hydraulically actuated with manual reversion; mass-balanced elevators and rudder actuated mechanically by push/pull rods; servo tab in port aileron, trim tabs in rudder and each elevator, all operated electrically; ailerons deflect 15° up/15° down, elevators 20° up/10° down, rudder 25° to left and right. Hydraulically actuated single-slotted flaps, deflecting 20° for T-O and 40° for landing, retract gradually when airspeed reaches 162 kt (300 km/h; 186 mph); twin hydraulically actuated airbrakes under rear fuselage.

STRUCTURE: All-metal; aluminium honeycomb ailerons/elevators/rudder; semi-monocoque fuselage includes honeycomb panels for fuel tank compartments; machined wing skin panels form integral fuel tanks.

LANDING GEAR: Retractable tricycle type, with single wheel and oleo-pneumatic shock-absorber on each unit, main-wheels retract inward, casting nosewheel forward, all being fully enclosed by doors when retracted. Landing light in port wingroot leading-edge. Mainwheels fitted with tubeless tyres, size 552x164-10, pressure 7.5 bar (109 lb/sq in), and hydraulic disc brakes with anti-skid system. Nosewheel has tubeless tyre size 445x150-6, pressure 4.0 bar (58 lb/sq in).

POWER PLANT: One Turbomecanica Romanian-built Rolls-Royce Viper Mk 632-41M turbojet, rated at 17.79 kN (4,000 lb st). Fuel in two flexible bag tanks in centre-fuselage, capacity 900 litres (238 US gallons; 198 Imp gallons), and four integral tanks between wing spars, combined capacity 470 litres (124 US gallons; 103 Imp gallons). Total internal fuel capacity 1,370 litres (362 US gallons; 301 Imp gallons). Gravity refuelling point on top of fuselage. Provision for two drop tanks, each of 280 litres (74.0 US gallons; 61.5 Imp gallons) capacity, on inboard underwing stations. Maximum internal/external fuel capacity 1,930 litres (510 US gallons; 424 Imp gallons).

ACCOMMODATION: Crew of two in tandem, on Martin-Baker Mk 10L zero/zero ejection seats in pressurised and air conditioned cockpit. Rear (instructor's) seat elevated 35 cm (13.8 in). Dual controls standard. One-piece canopy with internal screen, opening sideways to starboard.

SYSTEMS: Engine compressor bleed air for pressurisation, air conditioning, anti-g suit and windscreen anti-icing system, and to pressurise fuel tanks. Hydraulic system, operating at pressure of 206 bar (2,990 lb/sq in), for actuation of landing gear and doors, flaps, airbrakes, ailerons and main-wheel brakes. Emergency hydraulic system for operation of landing gear doors, flaps and wheel brakes. Main electrical system, supplied by 9 kW 28 V DC starter/generator, with 28 V 36 Ah Ni/Cd battery, ensures operation of main systems, in case of emergency, and engine starting. Two static inverters (one 3 kVA and one 750 kVA) supply two secondary AC networks: 115 V/400 Hz and 26 V/400 Hz. Oxygen system for two crew for 2 hours 30 minutes.

AVIONICS: Elbit Systems integrated suite, based on MIL-STD-1553B.

Comms: Dual VHF/UHF com; voice-activated intercom; IFF.

Flight: VOR/ILS; DME; ADF; Litton Italia INS with Trimble GPS nav.

Instrumentation: Modular multirole computer; HOTAS controls; head-up display with up-front control panel (HUD/UFCP), plus one LCD MFD and one CRT MFD, in front cockpit; two CRT MFDs (one as ASHM, or aft station HUD monitor) in rear (instructor's) cockpit; dual ADIs with HSIs; radar altimeter; Elta data transfer system (DTS) with pilot's virtual radar display; pilot's and instructor's display and sight helmets (DASH).

Self-defence: Elta RWR and ECM (jammer) pod; chaff/flare dispenser.



Avioane IAR-99C Șoim (Romanian Air Force)

1158618

ARMAMENT: Five external stores stations. Centreline station can be occupied by ECM, laser designator or aerial reconnaissance pod, a drop fuel tank, or by a twin-barrel 23 mm GSh-23 gun pod with 200 rounds. All armament controlled by stores management system slaved to avionics mission computer. Four underwing hardpoints stressed for loads of 250 kg (551 lb) each. Typical underwing stores can include four 250 kg bombs; four triple carriers each for three 50 kg bombs (or two 100 kg and one 50 kg); laser- or IR-guided bombs (inboard pylons only); R-3, R-13, R-60 or Python 3 AAMs (outer pylons only); four L-16-57 launchers each containing sixteen 57 mm air-to-surface rockets; and auxiliary fuel tanks (see under Power Plant) on inboard pylons.

DIMENSIONS, EXTERNAL:

Wing span	9.85 m (32 ft 3 3/4 in)
Wing chord: at root	2.305 m (7 ft 6 3/4 in)
mean	1.965 m (6 ft 5 1/4 in)
at tip	1.30 m (4 ft 3 3/4 in)
Wing aspect ratio	5.2
Length overall	11.01 m (36 ft 1 1/2 in)
Height overall	3.90 m (12 ft 9 1/2 in)
Elevator span	4.12 m (13 ft 6 1/4 in)
Wheel track	2.685 m (8 ft 9 3/4 in)
Wheelbase	4.38 m (14 ft 4 1/2 in)

AREAS:

Wings, gross	18.71 m ² (201.4 sq ft)
Ailerons (total)	1.56 m ² (16.79 sq ft)
Flaps (total)	2.54 m ² (27.34 sq ft)
Fin, incl dorsal fin	1.92 m ² (20.67 sq ft)
Rudder	0.63 m ² (6.78 sq ft)
Tailplane	3.125 m ² (33.63 sq ft)
Elevators (total)	1.25 m ² (13.45 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	3,200 kg (7,055 lb)
Max fuel weight: internal	1,100 kg (2,425 lb)
external	350 kg (772 lb)
Max T-O weight: trainer	4,400 kg (9,700 lb)
ground attack	5,560 kg (12,258 lb)

Max wing loading: trainer	235.2 kg/m ² (48.17 lb/sq ft)
ground attack	297.2 kg/m ² (60.86 lb/sq ft)
Max power loading: trainer	247.5 kg/kN (2.42 lb/lb st)
ground attack	312.7 kg/kN (3.06 lb/lb st)

PERFORMANCE:

Max operating Mach number (MMO)	0.76
Max level speed at S/L:	
trainer, clean	467 kt (865 km/h; 537 mph)
Max speed for landing gear actuation	135 kt (250 km/h; 155 mph)
Max rate of climb at S/L	2,100 m (6,890 ft)/min
Service ceiling	12,900 m (42,325 ft)
Min air turning radius	330 m (1,083 ft)
T-O run: trainer	450 m (1,477 ft)
ground attack	960 m (3,150 ft)
T-O to 15 m (50 ft): trainer	750 m (2,461 ft)
ground attack	1,350 m (4,430 ft)
Landing from 15 m (50 ft): trainer	740 m (2,428 ft)
ground attack	870 m (2,855 ft)
Landing run: trainer	550 m (1,805 ft)
ground attack	600 m (1,969 ft)
Typical combat radius (one pilot, ventral gun, internal fuel only):	
lo-lo-hi, four 16-round rocket pods, AUW 5,000 kg (11,023 lb)	189 n miles (350 km; 217 miles)
hi-lo-hi, two 16-round rocket pods, two 50 kg and four 100 kg bombs, AUW 5,280 kg (11,640 lb)	186 n miles (345 km; 214 miles)
hi-hi-hi, four 250 kg bombs, AUW 5,480 kg (12,081 lb)	208 n miles (385 km; 239 miles)

Max range with internal fuel:

trainer	593 n miles (1,100 km; 683 miles)
ground attack	522 n miles (967 km; 601 miles)
Max endurance with internal fuel: trainer	2 h 40 min
ground attack	1 h 46 min
g limits	+7/-3.6

GM&T

GM&T INTERNATIONAL 2000 SA

Str Boja Nr 1B Sect 6, R-77612 Bucharest

Tel: (+40 21) 434 26 11

Fax: (+40 21) 434 26 12

e-mail: mihai.mantescu@gmti.ro

Web: www.gmti.ro

GENERAL MANAGER: Mihai Mantescu

Formed in 2000, GM&T obtained production rights of Pretty Flight ultralight from PC Aero of Germany. This manufactured in 460 m² (4,950 sq ft) premises in Bucharest and marketed in Europe by Aero Service Albert Dietrich (www.pilot-ul.de) of Germany. The company also produces and markets doors and windows for the construction industry.

GM&T PRETTY FLIGHT

TYPE: Side-by-side ultralight/kitbuilt.

PROGRAMME: Designed by Calin Gologan. Prototype (D-MNPF, c/n 01) first flew in Germany in November 1996, having been assembled by Nitsche Flugzeugbau from Romanian components fabricated by Star Tech Impex Srl. First flight of production aircraft (D-MOOL, c/n 001) 10 November 1997; German certification achieved 25 September 1998; three pre-series aircraft then completed; manufacture of first batch of 10 series production aircraft began in November 1998, but programme suspended until taken over by GM&T: first GM&T aircraft (D-MMPF) built by Peter Kuehnl in Germany and exhibited at Aero '05, Friedrichshafen, in April 2005.

Current version considerably modified, including new engine and propeller; ailerons and flaps replacing flaperons; modified all-moving tailplane with revised trim; reprofiled rear fuselage using one-piece frames; reprofiled front fuselage with rounded surfaces and new engine cowlings; nosewheel steering; and revised instrumentation and interior outfitting.

CURRENT VERSIONS: **Ultralight:** As described.

Kit: Quoted build time 300 hours.

COSTS: EUR72,500 (Sport version) or EUR75,980 (Elite), including German taxes, flyaway (2006).

DESIGN FEATURES: High-wing braced monoplane with upturned wingtips and sweptback fin. Wing section GAW PC-1.

FLYING CONTROLS: Manual. Conventional ailerons and horn-balanced rudder; all-moving tailplane with anti-balance tabs. Electrically-actuated flaps.

STRUCTURE: Predominantly metal, with fabric-covered rear wing panels and control surfaces.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring cantilever mainwheel legs; optional wheel fairings. Steerable nosewheel with compressed rubber shock-absorber.



GM&T Pretty Flight assembled by Peter Kuehnl (Paul Jackson)

1159366

POWER PLANT: One 55.2 kW (74 hp) Parma-Technik Mikron IIIB in-line, four-cylinder engine driving a Woodcomp two-blade, fixed-pitch wooden propeller. Fuel in two tanks, combined capacity 105 litres (27.7 US gallons; 23.1 Imp gallons).

EQUIPMENT: BRS 1050 or USH 520 parachute recovery system.

DIMENSIONS, EXTERNAL:

Wing span	10.00 m (32 ft 9 3/4 in)
Length overall	6.03 m (19 ft 9 1/2 in)
Height overall	2.57 m (8 ft 5 1/4 in)

DIMENSIONS, INTERNAL:

Cabin max width	1.16 m (3 ft 9 3/4 in)
-----------------	------------------------

AREAS:

Wings, gross	13.50 m ² (145.3 sq ft)
--------------	------------------------------------

WEIGHTS AND LOADINGS:

Weight empty, excluding parachute	287 kg (633 lb)
Max T-O weight	472.5 kg (1,041 lb)

PERFORMANCE:

Max level speed	111 kt (206 km/h; 128 mph)
Cruising speed at 75% power	97 kt (180 km/h; 112 mph)
Stalling speed	36 kt (65 km/h; 41 mph)
Max rate of climb at S/L	240 m (787 ft)/min
T-O run	200 m (660 ft)
Landing run	150 m (495 ft)
Range	up to 567 n miles (1,050 km; 652 miles)

IAR

SC IAR SA

1 Aeroportului Street, R-507075 Brasov

Tel: (+40 268) 47 51 08 and 47 52 69

Fax: (+40 268) 47 69 81

e-mail: sales@iar.ro

Web: www.iar.ro

PRESIDENT AND CEO: Ion Georgescu

COMMERCIAL AND FINANCIAL DIRECTOR: Ion Dumitrescu

DEVELOPMENT AND PRODUCTION DIRECTOR: Andrei Lorincz

SALES AND CUSTOMER SUPPORT MANAGER: Aurel Sultana

Factory, established 1925 and fully rebuilt 1968, continues work begun by IAR-Brasov; occupies 134 ha (331 acre) site, including 76,000 m² (818,060 sq ft) factory area, and had 2006 workforce of about 1,200. Now the sole Romanian manufacturer of helicopters, it has produced more than 200 Alouette IIIs and over 165 Pumas under French licence.

IAR SA has the experience and capacity to develop and produce aeronautical products, and is a major supplier to the Romanian MoD. Currently, it performs upgrading programmes; revisions and overhauls; flight testing; extensive after-sales services; maintenance; spare parts and replacements; technical services and assistance; pilot and crew training; and IAR-330 Puma follow-on support. Other work includes co-operation programmes with worldwide manufacturers of tooling, subassemblies and parts for a variety of aircraft.

As a first stage in progress towards privatisation, IAR SA was restructured in 2004 into three separate companies, two-thirds of each being owned by the Romanian government and the balance by private shareholders. One of these new companies, also known as IAR SA,

specialises in work involving Alouette III and Puma helicopters and owns 49 per cent of the shares in the Eurocopter Romania SA joint venture created in June 2001. Its recent and current main programmes are the Puma SOCAT upgrade to meet Romanian MoD requirements for an advanced armed helicopter; 25th and last was delivered 9 June 2005; and Puma SM, an advanced multirole helicopter for the UAE armed forces, which involves Makila 1A1

re-engining, advanced avionics, new autopilot and new optional equipment. The latter programme is a co-operative one with Eurocopter SAS and other major companies.

IAR also designed and produced IAR-465 very light aircraft; has produced more than 830 IS-28M2/GR motor gliders and IS-28/29/35 series gliders; spares for IAR-330 Puma and IAR-316 B Alouette III helicopters; aircraft components.

ROMAERO

SC ROMAERO SA

44 Bulevardul Ficusului, Sector 1 (PO Box 18), R-71544 Bucuresti 1

Tel: (+40 21) 599 41 01

Fax: (+40 21) 599 43 25

e-mail: office@romaero.ro

Web: www.romaero.ro

PRESIDENT AND CEO: Viorel Manole

DIRECTORS:

Valeriu Adamache (Production)

Constantin Dinischiotu (Commercial)

Andrei Elena (Finance)

Lucian Popescu (Strategic Planning)

PUBLIC RELATIONS: Carmen Gheorghiu

Romaero is an EASA- and FAA-approved airframe manufacturer and aircraft maintenance organisation with a reliable reputation as a partner of Western integrators. It was known initially for its production of the Britten-Norman/BNG Islander and Defender, which began in

1968. This was suspended in 1997 (more than 520 built), but was resumed in July 2002 with new contract for 24 aircraft during ensuing two years.

As a JAR/FAR 21-approved supplier, Romaero has manufactured and delivered items to Boeing (737/757/767/777 major subassemblies and components); Bombardier (415 water bomber cabin subassemblies and floats, Challenger 604 auxiliary fuel tanks and Learjet 45 tail units); BAE Systems (ATP and Avro RJ85/RJX detail parts and subassemblies); and IAI/Gulfstream (Astra SPX/G100 cabins and Galaxy/G200 rear fuselages). More recently, it entered into co-operation with BAE Systems to manufacture Nimrod subassemblies and parts and ATP large freight doors (LFD); AgustaWestland for A 109 Power tailboom assemblies; and Sabca to produce structural assemblies and subassemblies for the Airbus A380 programme. In 2004, it installed LFDs in three ATP freighter conversions for Emerald Airways under BAE Systems subcontract.

In addition, Romaero's JAR/FAR 145-approved maintenance, repair and overhaul (MRO) status currently covers such work on various aircraft types, including the Islander, BAC One-Eleven, Boeing 727/737/757, Hawker 800 XP, Lockheed Martin C-130, McDonnell Douglas/Boeing DC-9 and MD-80 series, and Airbus A320.

Romaero's 364,347 m² (3,921,800 sq ft) site includes a 163,670 m² (1,761,725 sq ft) production facility and a further 147,096 m² (1,583,325 sq ft) of covered space. Workforce was approximately 1,300 in January 2003.

Russian Federation

AERO-ASTRA

AVIATSIONNYY NAUCHNO-YEKHNICHESKIY TSENTR AERO-ASTRA

ul Michurina D 4a, Zhukovsky, 140180 Moskovskaya oblast

Tel: (+7 095) 670 02 92

e-mail: aero-astra@newmail.ru

Web: www.aero-astra.ru

DIRECTOR: Viktor V Shumeiko

EXECUTIVE DIRECTOR: Maksim V Ipatov

Company formed in 1979 to develop autogyros, most recently the first three-seat vehicle in Russia.

AERO-ASTRA OKHOTNIK

English name: Hunter

TYPE: Three-seat autogyro.

PROGRAMME: Prototype constructed and flown in 2001-02, powered by 97 kW (130 hp) Subaru EJ-25 engines and with 8.53 m (28 ft) Dragon Wings rotor; later Rotary Air Force rotor. Initial flight with pilot and three passengers achieved on 16 October 2002. Second prototype flew 28 March 2003 with RAF 9.14 m (30 ft) rotor; intended to test 9.75 m (32 ft) SportCopter. Production version, Okhotnik 3, with windscreen and part-enclosure for occupants, shown at Moscow Salon in August 2005.

CUSTOMERS: Three of two-seat version delivered between late 2005 and early 2006.

COSTS: Flyaway EUR45,000 (2003). Kit version available later.

DESIGN FEATURES: Pusher autogyro with V tail and automatic gust-compensating vane mounted at rear of rotor pylon, immediately below hub. Hydraulic pre-rotator for RAF 2000 (optionally SportCopter) two-blade main rotor.

LANDING GEAR: Tricycle type; fixed.

POWER PLANT: Twin Subaru motorcar engines, combined output 157 kW (210 hp), driving a five-blade, KievProp pusher propeller.

ACCOMMODATION: Pilot and two passengers; latter seated each side of rotor mast.

AVIONICS: Stratomaster combined engine and flight instrumentation display.



Aero-Astra Okhotnik three-seat autogyro (Yefim Gordon)

1159016

WEIGHTS AND LOADINGS:

Weight empty 395 kg (871 lb)
Max T-O weight 700 kg (1,543 lb)

PERFORMANCE (provisional):

Max level speed 86 kt (160 km/h; 99 mph)
Cruising speed 54 kt (100 km/h; 62 mph)
Max rate of climb at S/L 120 m (395 ft)/min
T-O run 15 to 50 m (50 to 165 ft)
Landing run 0 to 3 m (0 to 10 ft)
Range 216 n miles (400 km; 248 miles)

AEROPRAKT

AEROPRAKT OOO (AEROPRAKT JSC)

Ypravlentshesky typik 8, 443022 Samara

Tel: (+7 846) 992 68 01

e-mail: aeroprakt@mail.ru

Web: www.aeroprakt.ru

GENERAL DIRECTOR: Andrey G Pozdnyakov

CHIEF CONSTRUCTOR: Vladimir V Gaslov

Formed in 1974 to design and build gliders, small aircraft, flying-boats and amphibians, OKB Aeroprakt established a second centre at Kiev in 1986, only to be divided on dissolution of the USSR. Became LM Aeroprakt Samara, a joint Russo-Finnish venture, in 1991; KB Aeroprakt in 1993; Aeroprakt JSC in 1997 and Aeroprakt-Samara JSC in 2000.

The Russian Aeroprakt adopts a -ct ending in transliteration to differentiate it from the Aeroprakt now in Ukraine (which see). The two companies are no longer connected. Chief designer Igor Vukhrushev was killed in the crash of an Aeroprakt-23M in June 2000, after which production was suspended temporarily and the company split into two: Avantazh which continued with the modified version of Aeroprakt-27, the 27M, shown at Moscow in August 2001 and Aeroprakt-Samara, which is responsible for the Aeroprakt-33, first flown at Moscow in August 2001. In 2005, preliminary details of the A-37 were revealed.

In addition to aircraft, the company also manufactures floats for aircraft in the 700 to 1,400 kg (1,540 to 3,085 lb) range.

AEROPRAKT A-33

TYPE: Side-by-side lightplane/kitbuilt.

PROGRAMME: Prototype (FLARF-01033) first flown 14 November 2001.

CUSTOMERS: Total of nine built by September 2006.

DESIGN FEATURES: Light tourer and sportplane with low-mounted, tapered wings, constant-chord tailplane and large, sweptback fin with small underfin. Meets JAR-VLA certification requirements.

FLYING CONTROLS: Conventional and manual. Horn-balanced elevator with central, flight-adjustable tab. Ailerons with external mass balances. Three-position (0, 20, 40°) flaps.

STRUCTURE: Generally of composites.

LANDING GEAR: Tricycle type; fixed. Cantilever mainwheel legs; leaf-spring steerable nosewheel, main wheels 4.00x150; nosewheel 300x125. Hydraulic brakes, optional floats and skis.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS flat-four driving a three-blade flight adjustable Kievprop propeller; three aircraft have 84.6 kW (113.4 hp) Rotax 914 UL fitted.

Fuel capacity 130 litres (34.3 US gallons; 28.6 Imp gallons).

ACCOMMODATION: Two persons, side by side, beneath two-piece, centreline-hinged canopy.

Baggage stowage behind seats.

SYSTEMS: Electrical system with 12 V 25 Ah battery and PR-A12-24 transformer.

AVIONICS: Commis: Briz radio.

Instrumentation: Standard VFR. Optional GPS.

EQUIPMENT: MVEN KC-700 parachute recovery system.

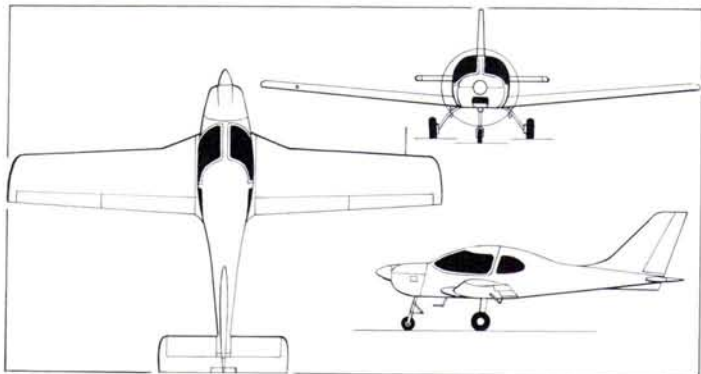
DIMENSIONS, EXTERNAL:

Wing span 9.575 m (31 ft 5 in)

Wing chord; at root 1.745 m (5 ft 8 3/4 in)



Aeroprakt-33 demonstrator 1159712



Aeroprakt-33 (Rotax 912 ULS engine) (James Goulding)

at tip	1.00 m (3 ft 3¼ in)
Wing aspect ratio	7.3
Length overall	6.64 m (21 ft 9½ in)
Height overall	2.61 m (8 ft 6¾ in)
Tailplane span	2.84 m (9 ft 4 in)
Tailplane chord (constant)	0.80 m (2 ft 7½ in)
Wheel track	2.00 m (6 ft 6¾ in)
Wheelbase	1.65 m (5 ft 5 in)
Propeller diameter	1.85 m (6 ft 0¾ in)
DIMENSIONS, INTERNAL:	
Cabin width	1.16 m (3 ft 9½ in)
Baggage volume	0.8 m³ (28 cu ft)
AREAS:	
Wings, gross	12.56 m² (135.2 sq ft)
Ailerons (total)	1.28 m² (13.78 sq ft)
Flaps (total)	1.92 m² (20.67 sq ft)
Fin (incl dorsal fin)	2.01 m² (21.64 sq ft)
Rudder, incl tab	0.52 m² (5.60 sq ft)
Tailplane	2.24 m² (24.11 sq ft)
Elevator, incl tab	1.08 m² (11.63 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	433 kg (955 lb)
Max payload	294 kg (648 lb)
Max T-O weight	750 kg (1,653 lb)
Max wing loading	59.7 kg/m² (12.23 lb/sq ft)
Max power loading: Rotax 912	10.20 kg/kW (16.76 lb/hp)
Rotax 914	8.87 kg/kW (14.58 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	135 kt (250 km/h; 155 mph)
Max operating speed: Rotax 912	116 kt (215 km/h; 134 mph)
Rotax 914	119 kt (220 km/h; 137 mph)
Cruising speed at 75% power	103 kt (190 km/h; 118 mph)
Econ cruising speed	81 kt (150 km/h; 93 mph)
Stalling speed, power off, flaps down	46 kt (85 km/h; 53 mph)
Rate of climb at S/L: Rotax 912	360 m (1,181 ft)/min
Rotax 914	240 m (787 ft)/min
Service ceiling	3,500 m (11,480 ft)
T-O run: Rotax 912	150 m (492 ft)

AEROPROGRESS/ROKS-AERO

AEROPROGRESS/ROKS-AERO

65A Volokolamskoye Shosse, 123424 Moskva

Tel: (+7 095) 145 88 60

Fax: (+7 095) 145 94 77

e-mail: aeroprogress@mtu-net.ru

PRESIDENT AND GENERAL DESIGNER: Evgeny P Grunin

DEPUTY GENERAL DESIGNER: Arnold I Andrianov

DEPUTY GENERAL DESIGNER, FOREIGN ECONOMIC RELATIONS: Alexander V Andreev

DESIGN BUREAU MANAGER: Sergei M Zhiganov

Known initially as ROS-Aeroprogress, this organisation was founded in 1990 to design and manufacture utility, commuter, amphibian, aerobatic, agricultural, firefighting, training and

Rotax 914	100 m (330 ft)
Range	809 n miles (1,500 km; 932 miles)
g limits	+4/-2

AEROPRAKT A-37

TYPE: Four-seat utility twin.

PROGRAMME: Development began in 2003, although aircraft not revealed until 2005. Prototype first flown 29 November 2005.

DESIGN FEATURES: High-wing lightplane with design elements of A-33 apparent.

FLYING CONTROLS: Conventional and manual. Flaps.

STRUCTURE: Strut-braced, constant-chord wing. Sweptback fin and underfin.

LANDING GEAR: Tricycle type; fixed. Optional twin floats.

POWER PLANT: Two 84.6 kW (113.4 hp) Rotax 914 UL engines driving three-blade propellers.

Fuel capacity 265 litres (70.0 US gallons; 58.3 Imp gallons).

ACCOMMODATION: Door on port side of fuselage; baggage door on port side of fuselage behind cockpit.

All data are provisional.

DIMENSIONS, EXTERNAL:

Wing span 12.00 m (39 ft 4½ in)

Length overall 7.20 m (23 ft 7½ in)

Height overall 3.70 m (12 ft 1¾ in)

AREAS:

Wings, gross 17.40 m² (187.3 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 850 kg (1,874 lb)

Max T-O weight 1,400 kg (3,086 lb)

PERFORMANCE:

Normal cruising speed 119 kt (220 km/h; 137 mph)

Service ceiling 3,500 m (11,480 ft)

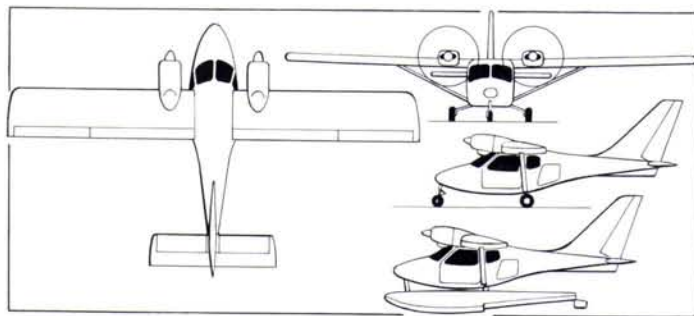
Range with max fuel 809 n miles (1,500 km; 932 miles)

g limits +4/-2



Prototyp Aeroprakt A-37

1159713



Aeroprakt A-37, with additional profile of optional seaplane (James Goulding)

1133248

attack aircraft, WIG (wing-in-ground-effect) vehicles, replicas and other vehicles. ROKS-Aero Inc is the design bureau of Aeroprogress. No new programmes have been announced for several years.

AEROPROGRESS/ROKS-AERO T-101 GRACH

English name: Rook

TYPE: Light utility turboprop.

PROGRAMME: Design started by Utility Aircraft Division in September 1991, as monoplane successor to Antonov An-2/3 biplane; construction of prototype started April 1992; first flight (FLARF-01466) 7 December 1994; no evidence of reported four additional prototypes, all of which are presumed to have been used for static testing.

Series manufacture by Moscow Aviation Production Organisation (MAPO) initiated January 1993; initial production aircraft shown unpainted at Lkhovitsy factory, August 1999; further seven then substantially complete. One T-101 delivered to Yakutia region in July 2000 on six-month lease, representing initial revenue-earning use; second supplied to undisclosed operator in early 2001 and third being prepared for delivery by late 2001. A Westernised version, developed via the Aeroprogress ROKS/Aero T-201, was unsuccessfully marketed as the Khrunichev T-201. In March 2002 Aeroprogress suggested it was looking for certification by 2004, but in June of that RSK 'MiG' admitted it was unable to provide the USD2 million needed to complete certification, even though several aircraft then partly complete on production line at LAPIK, Lkhovitsy, and Yakutia regional government interested in buying 10. In 2005, work on the T-101 appeared to have ceased as the factory concentrated on MiG-29 production.



Prototype Aeroprogress T-101 Grach on display at Lkhovitsy in 2004 (Yefim Gordon)

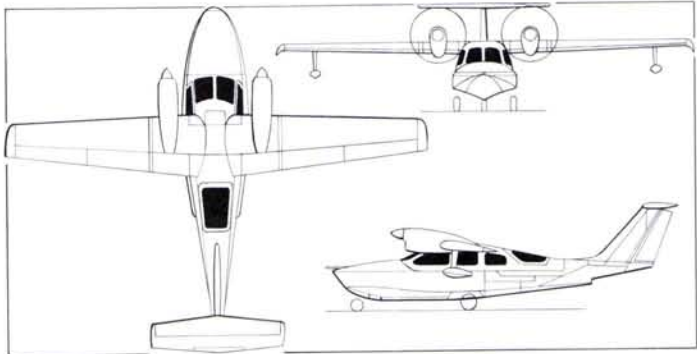
1044773

AERO-VOLGA

AERO-VOLGA OOO NPO

Smyshlyaevskoe Shosse, Dom 1a, Korpus 4, 443109 Samara
Tel/Fax: (+7 846) 249 85 33
e-mail: aerovolga.63@mail.ru
Web: www.aerovolga.com
CHAIRMAN: Sergey Alafinov
CHIEF ENGINEER: Sergey Seryogin
PRODUCTION DIRECTOR: Vladimir Shish
MARKETING DIRECTOR: Matvey Shchelochkov

Two prototypes of this company's twin-engine proof-of-concept L-6 amphibian have been flown: the original aircraft in June 2000 and a modified L-6M in September 2003, the company having meanwhile (2002) been officially constituted. In 2003, AeroVolga announced the similar LA-8 Flagman, which intended as the production version. In 2005, AeroVolga was evaluating an offer from Siberian city of Megion to establish LA-8 production in new plant. Agreement signed at Moscow Air Show 17 August 2005 with Diamond Aircraft of Austria covering Russian promotion and assembly at Samara of Katana lightplane, while Diamond to promote LA-8 in West.



AeroVolga LA-8 Flagman amphibian (James Goulding)

AEROVOLGA LA-8 FLAGMAN

TYPE: Utility amphibian.
PROGRAMME: Project announced 2003 as development of L-6. Certification application lodged 27 April 2004; first flight 20 November 2004 (RA-0344G); exhibited at Moscow Salon in August 2005. Certification to AP-23 and international equivalents and launch of production planned in 2006.
CUSTOMERS: Interest reported from potential buyers in Canada, Denmark, Norway and Sweden.
DESIGN FEATURES: High-wing amphibian. Wings strut-braced and with engines mounted on upper surface; stabilising floats at approximately three-quarter span, T-type tail. Downturned wingtips.
FLYING CONTROLS: Conventional and manual. Flaps.
STRUCTURE: Composites, with monocoque hull.
LANDING GEAR: Nosewheel type; retractable. Mainwheels, size 476x168, nosewheel 400x150. Minimum ground turning radius 14.0 m (46 ft).
POWER PLANT: Two LOM M337AK petrol engines, each 158 kW (212 hp), driving Avia V546 variable-pitch propellers. Optionally two 173 kW (232 hp) LOM M337B or 184 kW (247 hp) M337C six-cylinder piston engines and MT-Propeller or Hartzell variable-pitch propellers. Fuel capacity 380 litres (100 US gallons; 83.6 Imp gallons); provision for two long-range tanks with combined capacity of 300 litres (79.3 US gallons; 66.0 Imp gallons).
ACCOMMODATION: Eight persons, including up to two pilots. Main access hatch at rear of cabin, top; auxiliary hatch above pilots; two emergency exits, port and starboard.
AVIONICS: Garmin equipment standard.
EQUIPMENT: Optional ballistic parachute.
DIMENSIONS, EXTERNAL:
Wing span 13.08 m (42 ft 11 in)
Length overall 11.10 m (36 ft 5 in)
Max width of fuselage 2.00 m (6 ft 6 3/4 in)
Height overall 3.40 m (11 ft 1 3/4 in)

Wheel track	1.78 m (5 ft 10 in)
Wheelbase	3.43 m (11 ft 3 in)
Main hatch (upper rear):	
Length	1.69 m (5 ft 6 1/2 in)
Width	1.29 m (4 ft 2 3/4 in)
Auxiliary hatch (upper front):	
Length	0.45 m (1 ft 5 3/4 in)
Width	0.58 m (1 ft 10 3/4 in)
Emergency exits (two):	
Length	0.68 m (2 ft 2 3/4 in)
Width	0.68 m (2 ft 2 3/4 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	3.45 m (11 ft 3 3/4 in)
Max width	1.64 m (5 ft 4 1/2 in)
Max height	1.24 m (4 ft 0 3/4 in)
Volume	3.7 m ³ (131 cu ft)
AREAS:	
Wings, gross	18.60m ² (200.2 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	1,400 kg (3,086 lb)
Payload: max	670 kg (1,477 lb)
for max range	463 kg (1,020 lb)
Max fuel weight (normal)	274 kg (604 lb)
Max T-O and landing weight	2,300 kg (5,070 lb)
Max wing loading	123.7 kg/m ² (25.33 lb/sq ft)
Max power loading	7.28 kg/kW (11.96 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	164 kt (305 km/h; 189 mph)
Max level speed	140 kt (260 km/h; 164 mph)
Normal cruising speed	119 kt (220 km/h; 139 mph)
Stalling speed, power off: flaps up	69 kt (127 km/h; 79 mph)
flaps down	52 kt (95 km/h; 59 mph)



Prototype AeroVolga LA-8 Flagman (Yefim Gordon)

1153797

Max rate of climb at S/L 336 m (1,102 ft)/min
 Max certified altitude 3,000 m (9,840 ft)
 T-O run: land 300 m (985 ft)
 water 350 m (1,150 ft)

Range 647 n miles (1,200 km; 745 miles)
 Endurance 5 h 40 min
 g limits +3.8/-1.9

ALBATROS

TSENTR NAUCHNO-TEKHNICHESKOGO TVORCHESTVA ALBATROS

(ALBATROS SCIENTIFIC-TECHNICAL WORKS)
 ulitsa Tsentral'naya 22/126, 142092 Troitsk, Moskovskaya oblast
 Tel/Fax: (+7 096) 601 66 76
 GENERAL DIRECTOR: Valery Daryin

Original Aviacomplex company established in 1990 to build prototypes of the AS-2 two-seat lightplane. Renamed Albatros on 16 June 1991. Testing of the AS-2 was completed in collaboration with CAHI (TsAGI) and LII Flight Research Institute. Production by Aviacomplex and Myasishchev Engineering Bureau, with participation by other Russian companies. At 1999 Moscow Air Show (MAKS), a production AS-2 was shown under new designation of Albatros AS-3A and first details were revealed of a development, the Sigma-4, but no further details of either aircraft have been received from Albatros. However, the Sigma-4 was shown at the 2003 MAKS, credited to Elitar and is now being marketed in US.

The AS-3A designation appears to have been re-applied to a considerably revised design, incorporating a pusher propeller, of which basic details have been received. In addition, Albatros produces plans for a variety of light engineering equipment, as well as lathes for home use.

ALBATROS AS-3A

TYPE: Tandem-seat ultralight.

PROGRAMME: Production aircraft built at Kazan.

CUSTOMERS: At least two flying with aero club at Podolsk, Moscow region. No further information received.

COSTS: USD9,800 with engine; USD6,800 without engine (2004).

DESIGN FEATURES: High wing, open cockpit (with optional enclosure), pusher configuration with constant-chord, V-strut braced wings and strut-braced tailboom. Rear occupant's seat is raised.

FLYING CONTROLS: Conventional and manual. Flaps.

STRUCTURE: Duralumin tube and fabric; composites nacelle.



Albatros AS-3A tandem-seat ultralight

0561694

LANDING GEAR: Tricycle type; fixed.

POWER PLANT: One 44.7 kW (60 hp) piston engine driving a two-blade, pusher propeller.

EQUIPMENT: Ballistic parachute.

DIMENSIONS, EXTERNAL:

Wing span 9.80 m (32 ft 1 3/4 in)

Length overall 6.80 m (22 ft 3 3/4 in)

AREAS:

Wings, gross 14.85 m² (159.8 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 240 kg (529 lb)

Max T-O weight 420 kg (925 lb)

PERFORMANCE:

Max level speed 65 kt (120 km/h; 75 mph)

Normal cruising speed 49 kt (90 km/h; 60 mph)

Max rate of climb at S/L 180 m (591 ft)/min

T-O run 60 m (200 ft)

Range: with max fuel 540 n miles (1,000 km; 621 miles)

 with two crew 162 n miles (300 km; 186 miles)

ARSENYEV

ARSENYEVSKOYE AVIATIONNOYE PROIZVODSTVENNOYE PREDPRIYATIE IMENI N I SAZYKINA (ARSENYEV AVIATION PRODUCTION ENTERPRISE 'PROGRESS' NAMED FOR N I SAZYKIN)

prospekt Lenina 5, 692335 Arsenyev, Primovsky Kray

Tel: (+7 423) 614 52 32

Fax: (+7 423) 614 50 93

e-mail: aacprogress@mail.primorye.ru

Web: www.aacprogress.da.ru

GENERAL DIRECTOR: Vladimir Pechyonkin

Established in 1936 and originally designated GAZ 116, Arsenyev plant previously built the Mil Mi-24/25/35 series of combat helicopters, in parallel with Rostvertol, and was also

manufacturer of the Yak-55 aerobatic lightplane; a modified version of the last-mentioned, the Technoavia SP-55, was nominally returned to production in 1999. Overhaul facilities for Mi-24 are available.

Arsenyev is responsible currently for the Kamov Ka-50, Ka-52 and Mil Mi-34 helicopters, as well as Moskit missiles. It was reportedly assigned the new Kamov Ka-60, but that programme has been reallocated to RSK 'MiG', Russian government shareholding is 51 per cent, Ka-50 deliveries to Russian Air Forces were expected to begin with three helicopters in 2005, but these still on production line in January 2006.

A government decree of 31 December 1997 authorised the Arsenyev plant to offer the Ka-50 for export and supply spares and support for existing Mi-24/25/35 helicopters. Overseas delivery of P-15U, P-20, P-21 and P-22 cruise missiles is also covered.

Official plans announced on 12 May 2001 called for the Arsenyev plant to be incorporated in the proposed grouping to include RSK 'MiG', Tupolev and Kamov.

In December 2005, Arsenyev was reported to be preparing for production in 2006 of six Yak-54s (*sic*), representing part of an initial batch of 30 for ROSTO and other customers.

AVANTAZH

SAMOLETSTROITEL'NYI KOMPANIYA AVANTAZH (ADVANTAGE AIRCRAFT BUILDING COMPANY LTD)

(Advantage Aircraft Building Company Ltd)

PO Box 8760, 443034 Samara

Tel: (+7 8462) 270 01 64

Fax: (+7 8462) 931 43 13

e-mail: skavantage@samtel.ru

Web: www.sk-avantage.narod.ru

BRANCH DIRECTOR: Viktor T. Kuznetsov

GENERAL DIRECTORS:

Aleksandr A. Markov

Yuri A. Chondrukov

Avantazh, which adopts the English transliteration 'Avantage' (advantage), was formed on 21 August 2000 to market the former Aeropract A-21, A-23, A-25 and A-27 light aircraft. In 2002, it added the A-29 to its product line, followed by the A-31 And A-35. Production is set at 10 to 12 aircraft per year.

In addition, the company also carries out modification work on Il-62, Tu-134, Tu-154 and Yak-42 airliners.

AVANTAGE A-27

TYPE: Side-by-side lightplane/kitbuilt.

PROGRAMME: Prototype (FLARF-02647) first flew (in floatplane configuration) 22 June 1998; public debut at Gelendzhik 98 seaplane show, and in landplane version at MAKS, Moscow, August 1999; evaluated during 1999 and 2000 by AvtoZavod Flying Club in Togliatti. Seventh production airframe, under construction in mid-2001, is first with Rotax 914 engine.

CURRENT VERSIONS: **A-27:** Baseline version with Hirth engine.

A-27M Advantage: Version with 73.5 kW (98.6 hp) Rotax 912 ULS engine driving a Kiev ground-adjustable pitch propeller or 84.6 kW (113.4 hp) Rotax 914 ULS, driving a variable-pitch propeller. Several minor design changes, including more rounded forward lower fuselage surfaces, but description generally as for A-27, except where indicated.



Aeropract-27M Advantage two-seat lightplane (Paul Jackson)

0547744

CUSTOMERS: In early 2004, it was disclosed that the A-27M had been chosen by the government of Kyrgyzia for a joint venture, with development of the aircraft for the Ministry of Ecology and Emergency Situations, the Border Service and the Agency for the Control of Narcotics. One aircraft was reported to have been tested; further development was contingent on the necessary funding being available.

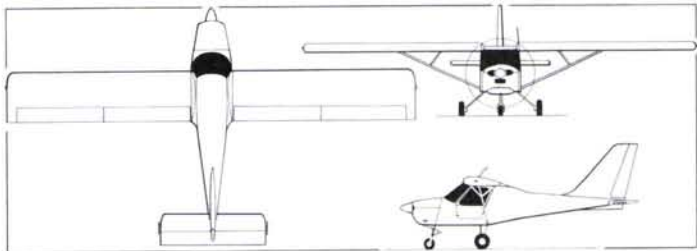
In March 2005, company announced sale of one A-27-24 to OOO Agroalliance.

COSTS: Kit USD14,000, excluding instruments (USD700), landing gear and Rotax 912 engine (USD14,000). Ex-works, complete, with wheels, USD35,500 (1999). Wheel landing gear USD1,000; skis USD250 to USD350; floats USD1,200 and USD1,650.

DESIGN FEATURES: Braced, high-wing monoplane with single main and two jury struts each side. Sweepback fin and rudder; unswept wings and horizontal tail. Meets JAR-VLA certification requirements.

FLYING CONTROLS: Manual. Ailerons, rudder and all-moving tailplane with anti-balance tab.

Flaps. A-27M has fixed tailplane with elevators, and ailerons with external mass balances. STRUCTURE: Tube metal fuselage with composites skin.



Aeropract-27M Advantage (James Goulding)0121662

LANDING GEAR: Tricycle type; fixed. Cantilever, metal mainwheel legs; telescopic, leaf-sprung nosewheel leg. Mainwheel size 400x150; nosewheel size 300x125. Optional floats or skis.
POWER PLANT (A-27): One 70.8 kW (95 hp) Hirth F30 flat-four driving a four-blade, ground-adjustable pitch propeller. Fuel capacity: 80 litres (21.1 US gallons; 17.6 Imp gallons); (A-27M) 100 litres (26.4 US gallons; 22.0 Imp gallons).
ACCOMMODATION: Two persons, side by side; forward-hinged door each side. Luggage space behind seats.
AVIONICS: Standard VFR.

Data refer to both versions, except where indicated.

DIMENSIONS, EXTERNAL:	
Wing span: A-27	10.60 m (34 ft 9¼ in)
A-27M	10.00 m (32 ft 9¾ in)
Wing chord, constant	1.35 m (4 ft 5¼ in)
Length overall: A-27	6.30 m (20 ft 8 in)
A-27M	6.50 m (21 ft 4 in)
Height overall	2.22 m (7 ft 3½ in)
WEIGHTS AND LOADINGS:	
Weight empty: A-27	335 kg (739 lb)
A-27M	325 kg (717 lb)
Max T-O weight: A-27	600 kg (1,322 lb)
A-27M	650 kg (1,433 lb)
Max power loading: A-27	8.47 kg/kW (13.92 lb/hp)
A-27M	8.84 kg/kW (14.53 lb/hp)
PERFORMANCE:	
Max level speed: A-27	95 kt (175 km/h; 109 mph)
A-27M	97 kt (180 km/h; 112 mph)
Normal cruising speed: A-27	70 kt (130 km/h; 81 mph)
A-27M	70–81 kt (130–150 km/h; 81–93 mph)
T-O run	100 m (330 ft)
Range: A-27	324 n miles (600 km; 372 miles)
A-27M	540 n miles (1,000 km; 621 miles)

AVANTAGE A-29

TYPE: Two-seat lightplane.
PROGRAMME: Introduced in 2002. Marketed in a range of roles, including flight training, pipeline patrol and agricultural applications.
DESIGN FEATURES: Braced high-wing monoplane with single strut each side. Sweptback fin.
FLYING CONTROLS: Conventional and manual. Electromechanical flaps.
STRUCTURE: Fuselage, wing and flying controls of glass fibre reinforced composites.
LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring metal cantilever mainwheel legs; telescopic, leaf-sprung nosewheel leg. Drum brakes. Optional floats and skis.
POWER PLANT: One 96.9 kW (130 hp) Limbach 2400 flat-four engine driving a wooden two-blade MT-Propeller MTV-1A/L170-05 propeller.
ACCOMMODATION: Two persons, side by side.
SYSTEMS: MVEN KC-700 ballistic parachute.
DIMENSIONS, EXTERNAL:

Wing span	10.12 m (33 ft 2½ in)
Wing aspect ratio	7.5
Length overall	6.63 m (21 ft 9 in)
Height overall	3.07 m (10 ft 0¾ in)
Propeller diameter	1.70 m (5 ft 7 in)

AREAS:
Wings, gross 13.66 m² (147.0 sq ft)

WEIGHTS AND LOADINGS:	
Weight empty	540 kg (1,190 lb)
Max T-O weight	770 kg (1,697 lb)
Max wing loading	56.4 kg/m² (11.55 lb/sq ft)
Max power loading	7.95 kg/kW (13.06 lb/hp)

PERFORMANCE:	
Never exceed speed (VNE)	124 kt (230 km/h; 142 mph)
Max operating speed	121 kt (224 km/h; 139 mph)
Normal cruising speed	86 kt (160 km/h; 99 mph)
Stalling speed, flaps down	46 kt (85 km/h; 53 mph)
Max rate of climb at S/L	300 m (984 ft)/min
Service ceiling	3,500 m (11,480 ft)
T-O run	80 m (263 ft)
Landing run	90 m (295 ft)



Avantage A-291159709

AVANTAGE A-31 SPECTRUM

TYPE: Agricultural sprayer.
PROGRAMME: Go-ahead for prototype issued 12 May 2004; prototype has flown. Aircraft designed to meet AP-23 airworthiness standard.
DESIGN FEATURES: Low-wing cantilever monoplane.
FLYING CONTROLS: Conventional and manual.
STRUCTURE: Composites fuselage; metal tube wing and tail, latter with glass fibre skin.
LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted, spring cantilever mainwheel legs.
POWER PLANT: One 157 kW (210 hp) LOM Praha M337AK six-cylinder four-stroke engine driving a three-bladed Avia V-546 propeller.
ACCOMMODATION: Pilot only in ventilated cabin.
EQUIPMENT: Spraying equipment fitted on bar under wings; swath width 25 to 30 m (82 to 98 ft), coverage 150 ha (371 acres) per hour.
DIMENSIONS, EXTERNAL:

Wing span	13.60 m (44 ft 7½ in)
Wing aspect ratio	8.9
Length overall	7.91 m (25 ft 11½ in)
Height overall	2.66 m (8 ft 8¾ in)
Wheel track	2.50 m (8 ft 2½ in)
Wheelbase	4.90 m (16 ft 1 in)

AREAS:
Wings, gross 20.88 m² (224.75 sq ft)

WEIGHTS AND LOADINGS:	
Weight empty	820 kg (1,808 lb)
Max payload	364 kg (802 lb)
Max T-O weight	1,350 kg (2,976 lb)
Max wing loading	64.7 kg/m² (13.24 lb/sq ft)
Max power loading	8.60 kg/kW (14.13 lb/hp)

PERFORMANCE:	
Never exceed speed (VNE)	135 kt (250 km/h; 155 mph)
Max operating speed	125 kt (232 km/h; 144 mph)
Normal cruising speed	108 kt (200 km/h; 124 mph)
Spraying speed	70–81 kt (130–150 km/h; 81–93 mph)
Stalling speed, power off: flaps up	53 kt (97 km/h; 61 mph)
flaps down	42 kt (77 km/h; 48 mph)
Max rate of climb at S/L	312 m (1,024 ft)/min
Service ceiling	4,400 m (14,435 ft)
T-O run	84 m (276 ft)
Landing run	114 m (374 ft)
Range	302 n miles (560 km; 348 miles)



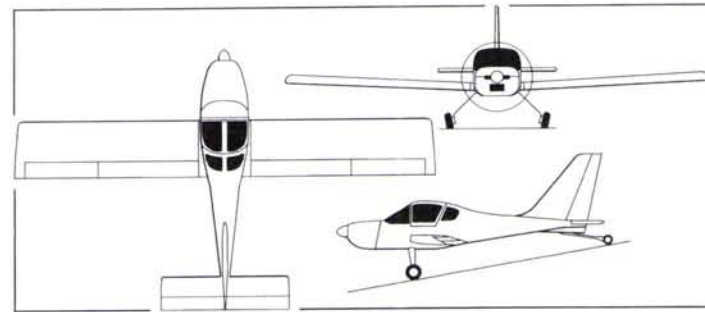
Avantage A-31 Spectrum1159710

AVANTAGE A-35 SCANNER

TYPE: Two-seat lightplane.
PROGRAMME: Go-ahead for prototype issued 12 May 2004; prototype has flown. Marketed as suitable for a range of tasks, including flight training and cropspraying.
DESIGN FEATURES: Low-wing cantilever monoplane. Similar to Aeropract-33.
FLYING CONTROLS: Conventional and manual.
STRUCTURE: Wing and fuselage of three-part composites.



Avantage A-35 Scanner1159711



Avantage A-35 Scanner general arrangement (Paul Jackson)1159695

LANDING GEAR: Tailwheel type; fixed. Fuselage-mounted, spring titanium cantilever mainwheel legs; drum brakes.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS flat four driving a Kiev 284/1800 three blade propeller.

ACCOMMODATION: Pilot and passenger side-by-side.

DIMENSIONS, EXTERNAL:

Wing span 10.215 m (33 ft 6¼ in)
Wing aspect ratio 7.6
Length overall 6.70 m (21 ft 11¾ in)
Height overall 3.07 m (10 ft 1 in)
Wheel track 2.305 m (7 ft 7 in)

AREAS:

Wings, gross 13.67 m² (147.14 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 477 kg (1,052 lb)
Max T-O weight 750 kg (1,653 lb)
Max wing loading 54.86 kg/m² (11.24 lb/sq ft)
Max power loading 10.20 kg/kW (16.77 lb/sq ft)
PERFORMANCE:
Never exceed speed (VNE) 118 kt (220 km/h; 136 mph)
Max operating speed 97 kt (180 km/h; 112 mph)
Normal cruising speed 81 kt (150 km/h; 93 mph)
Stalling speed, power off, flaps down 41 kt (75 km/h; 47 mph)
Max rate of climb at S/L 300 m (984 ft)/min
Service ceiling 3,500 m (11,480 ft)
T O run 80 m (263 ft)
Landing run 90 m (296 ft)
Range 486 n miles (900 km; 559 miles)

AVGUR

AVGUR VOZDUKHOPLAVATELNYI TSENTR (AUGUR AERONAUTICAL CENTRE)

ulitsa Stepana Shutova 4, 109380 Moskva

Tel/Fax: (+7 095) 359 10 01 and 359 10 65

Web: www.avgur.pbo.ru

WORKS: St Petersburg and Ulyanovsk

Tel/Fax (St Petersburg): (+7 812) 173 61 75

GENERAL DIRECTOR (ST PETERSBURG): Stanislav Vladimirovich Fedorov

Formed 29 October 1991 by the Moscow Aviation Institute and a group of private shareholders, this company is successor to AIG Kovanko, established in November 1986 by Mr Fedorov. Early achievements included first hot-air balloon flight over Moscow (AIGK Aist) in September 1989 and first Russian advertising aerostat (unmanned AP-60) in December 1989. Became joint stock company on 22 January 1993; St Petersburg division formed 4 November 1993, Ulyanovsk division 15 May 1996.

Current range of inflatables comprises BB, Au-2250 and VB hot-air balloons; Au-8 captive manned aerostat; Au-900 manned aerostat; Au-2, Au-5, Au-6 and Au-10 captive advertising aerostats; a range of small geostats; for RD-1.5, RD-2 and RD-2.5 remotely piloted small airships; see *Jane's Unmanned Aerial Vehicles and Targets*. Latest design is Au-29 Zyablik, revealed early 2005 and planned for series production in 2006 or 2007. Other activities include rental and leasing of airships and manufacture of ground-based inflatables of all kinds.

In 1997, Avgur became a founder member, with MAI, of the RosAeroSystems consortium.

AVGUR Au-29 ZYABLIK

English name: Chaffinch

TYPE: Hot air non-rigid airship.

PROGRAMME: Based on Au-26 hot-air tethered aerostat. First flight 18 December 2003.

Smallest known airship in its class. On 2 April 2005 set, subject to ratification, a BX-02

Class duration record of 46 minutes 38 seconds at Klisheva, piloted by Valery Shkulenko.

Intended for production in 2006 or 2007.

COSTS: USD40,000 (2005).

DESIGN FEATURES: Non-rigid, cruciform, inflatable tailfins, with rudder on lower vertical fin. Internal chambers of fins connected with main envelope volume, enabling air in fins to be heated and thus generating additional lift. Horizontal fins have adjustable deflection angle.

STRUCTURE: Envelope formed from 12 tapered gores of heat-resisting, ripstop polyamide fabric with silicone polyurethane coating, and pressurised from propeller slipstream via airscoop aft of gondola. Latter has a welded aluminium tube framework with four-point suspension from envelope.

POWER PLANT: One 20.9 kW (28 hp) MZ 35 piston engine with two-blade pusher propeller. Fuel capacity 10 litres (2.6 US gallons; 2.2 Imp gallons).

ACCOMMODATION: Single-seat.

DIMENSIONS, EXTERNAL:

Envelope: Length 23.42 m (76 ft 10 in)
Max diameter 8.73 m (28 ft 7¾ in)
Span over tailfins 9.20 m (30 ft 2¼ in)
Height overall 10.60 m (34 ft 9¼ in)
Propeller diameter 1.45 m (4 ft 9 in)

DIMENSIONS, INTERNAL:

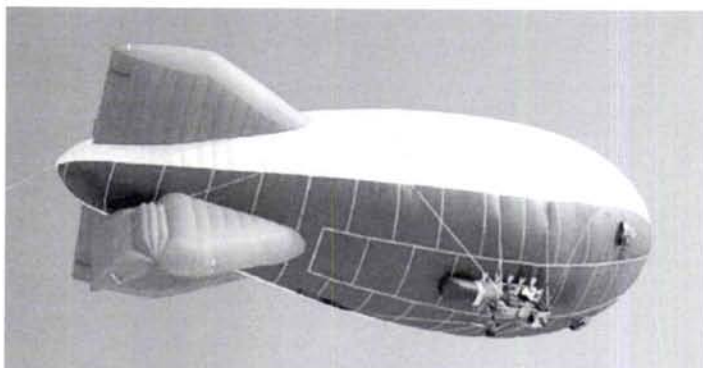
Envelope volume 855 m³ (30,194 cu ft)

WEIGHTS AND LOADINGS:

Envelope weight 60 kg (132 lb)
Max payload 150 kg (331 lb)
Gondola weight 70 kg (154 lb)

PERFORMANCE:

Max level speed 21 kt (40 km/h; 24 mph)



Avgur Au-29 prototype single-seat non-rigid

1127696

AUGUR Au-35

TYPE: Hot-air non-rigid airship.

PROGRAMME: First-stage prototype, named Polar Goose (*polyarnyy gus*), in science and technology development programme known as Altitude Launch, with eventual goal of using aerostats as high-altitude launch platforms for spacecraft. Subsequent stages will progress towards larger and more complex airships able to launch rockets carrying scientific and commercial payload experiments from stratosphere. Programme is supported by Russian Air Forces, Rostov (Society for Army, Aviation and Navy Support), Roscosmos, Russian Aeronautics Federation and Arctic Projects Foundation.

On 17 August 2006, piloted by Stanislav Fedorov and sponsored by Metropol investment company, Au-35 prototype took off from Moscow and flew to altitude of 8,150 m (26,740 ft), which claimed as new FAI absolute world record (previous record, 6,614 m; 21,700 ft, set in 2004). Airship is in BX 04 class (1,600 to 3,000 m³; 56,500 to 105,940 cu ft volume); no other data had emerged by press time.



Augur Au-35 being readied for its record attempt on 17 August 2006

1158803

AVIA

NAUCHNO-PROIZVODSTVENNOE OBEDINENIE AVIA LTD (AVIA SCIENTIFIC-PRODUCTION ASSOCIATION JSC)

Stroenie 1, 2-i Troitskiy pereulok 4, 129090 Moskva

Tel: (+7 095) 684 82 30

Fax: (+7 095) 681 13 91

e-mail: npo@aviatld.ru

Web: www.aviatld.ru

GENERAL DIRECTOR: Mikhail E Shibaev

SALES DIRECTOR: Vadim Salimov

OKB AKKORD (Accord Design Bureau)

ulitsa Chaadaeva 1a, 603035 Nizhny Novgorod

Tel: (+7 8312) 46 71 27

e-mail: accord@nnov.cityline.ru

Web: www.sokolplant.ru

DIRECTOR: Yuri Lakhtachev

EUROPEAN SALES AGENT:

Ground Support Equipment Srl

Viale del Vignola 44, I-00196 Roma, Italy

Tel: (+39 06) 322 28 77

Fax: (+39 06) 361 17 15

e-mail: gse srl@agora.it

Web: www.g-s-e.it

DIRECTOR: Roberto Salmoni

GENERAL MANAGER: Alfredo Romano

The Avia company was established on 20 February 1995 to design, manufacture and support light aircraft. Its associated design bureau (itself part of the Sokol plant) is responsible for the Accord range of light twin-engined aircraft. GSE of Italy was appointed as sales agent in 2000 and in 2005 Avia announced that rights to the Italian version to be known as Aermar-2001, had been transferred to the latter company.

AVIA ACCORD-201

TYPE: Light utility twin-prop transport.

PROGRAMME: Original (lightweight) Accord design began May 1991; first flew 18 April 1994. Production version is Accord-201; prototype flew 18 August 1997 at Nizhny Novgorod, initially with only VFR avionics and without floats. Demonstrations to prospective customers began December 1997; series of 12 flights from water, using floats, undertaken mid-1998. By early 1999, four more aircraft, including static test specimen, under construction and tooling in place for maximum possible production of 10 per month; by May 2004 when prototype had accumulated 200 hours. Russian AP-23 certification anticipated October 1999, but delayed, eventually beginning on 20 April 2000. Experimental category certificate, granted mid-2000 with expiry date of 19 June 2001. Hartzell propellers received Russian certification in October 2000. Full certification expected mid-2002, using Becker avionics in place of original Bendix/King equipment. However, certification had not been completed by May 2004 but was then expected by year-end; this revised to mid-2005. Second prototype had been due to fly in December 2001; this was eventually achieved on 20 July 2004.

CURRENT VERSIONS: Offered for a variety of roles, including SAR (201P), aerial survey (201AFS), ecological monitoring (201EM), sigint (201RC) and jamming (201REP). Latest provisional version is the 201TDI, to be powered by two 172 kW (230 hp) SR-305 turbo diesels and due to fly in September 2004, later revised to mid-2005 with intention of exhibiting at MAKS-2005 that August. The Italian version is to be known as the Aermar-2001.

CUSTOMERS: First firm order received in May 1998 from Almaz Rossii-Sakha diamond mining company, which ordered two to be used for geomagnetic survey and exploration. Customers in Abu Dhabi and Liechtenstein by 2000; however, because of certification delays, former contract under renegotiation and latter cancelled by late 2001. No further sales reported, although in 2004 the company was forecasting production of 12–15 aircraft per year, at which time five were under construction; this was increased to 25 per year by 2006.

COSTS: Standard aircraft USD298,000 on wheels; USD328,000 on floats; USD400,000–D500,000 for 201 TDI. Operating cost USD44 per hour (2000).

DESIGN FEATURES: High-wing monoplane with single bracing strut each side; unswept, high-lift wing section and blown flaps; pod and boom fuselage; cruciform tail surfaces with sweepback fin and rudder; mainwheels at tips of short stub-wings that support bracing struts. Constant-chord main wing panels, with engines on leading-edge; tapered outer panels. Service life 15,000 hours/15 years. Wing section CAHI (TsAGI) P-II, with 12 per cent thickness/chord ratio at root, CAHI (TsAGI) P-III at tip; tip sweepback 45°; no dihedral, incidence 1°, no twist.

FLYING CONTROLS: Conventional and manual. Ailerons and elevators 100 per cent balanced; twin horn-balanced rudders; all cable actuated. Three-axis electric trim. Two-section slotted flaps each side.

STRUCTURE: All-metal; D16 aluminium alloy and high-strength stainless steel. Fuselage based on welded rectangular-section cabin frame of steel tubing; remainder of airframe conventional light alloy construction.

LANDING GEAR: Tricycle type; fixed. Mainwheel legs levered, with oleo-pneumatic shock absorbers, mounted on sponsons attached to lower fuselage at attachment of wing bracing struts; single wheel on each unit. Cleveland wheels and brakes; mainwheels type 40–142 with 8.00-6 tyres; nosewheel type 40–140 with 6.00-6 tyres; type 30–127 disc brakes. Minimum turning circle 3.2 m (10 ft 6 in). Maximum nosewheel steering angle ±60°. Optional floats (additional to, not replacing, fixed landing gear) retract upward electrically, outside mainwheels.

POWER PLANT: Two 157 kW (210 hp) Teledyne Continental IO-360-ES7B flat-six engines; Hartzell PHC-H3YF-2UF/FC7453 three-blade, constant-speed, fully feathering propellers. Fuel tank in each engine nacelle; total capacity 750 litres (200 US gallons; 165 Imp gallons). Total oil capacity 15.2 litres (4.0 US gallons; 3.3 Imp gallons). In April 2004, two 169 kW (227 hp) SMA SR305 turbo-diesel engines were delivered for installation in one of the aircraft on the production line; in May 2006, it was announced that all amphibious versions would be diesel-powered.

ACCOMMODATION: Pilot and up to six passengers in 2-3-2 seating, at 80 cm (31.5 in) pitch. Alternatively, pilot and three passengers and cargo, or all-cargo, or one stretcher patient, one or two attendants and medical equipment. Optional dual controls. Two large upward-hinged side doors. Baggage/cargo hold at rear of cabin, with door.

SYSTEMS: SAU-201 autopilot, Webasto Air Top 32 cabin heater. Electrical system includes two 27 V Teledyne N653344 DC generators and one 19 Ah Gill G-247 battery. Elipos-3 pneumatic de-icing system for wing, fin and tailplane leading-edges; Goodrich electric propeller de-icing. Janitrol cabin heater.

AVIONICS: Mainly Becker equipment:

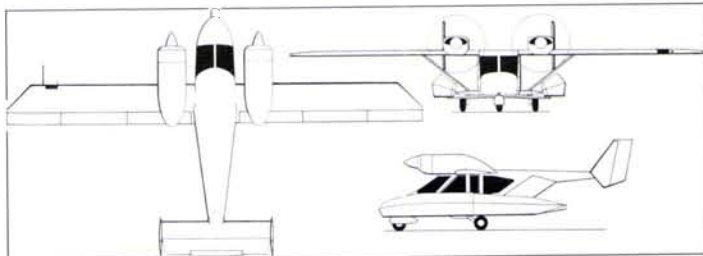
Radar: Weather radar optional.

DIMENSIONS, EXTERNAL:	
Wing span	13.75 m (45 ft 1¼ in)
Wing chord, constant	1.30 m (4 ft 3¼ in)
Wing aspect ratio	11.1
Length overall: landplane	8.12 m (26 ft 7¾ in)
amphibian	8.73 m (28 ft 7¾ in)
Height overall: landplane	2.94 m (9 ft 7¾ in)
amphibian	3.455 m (11 ft 4 in)
Span over tailfins	3.66 m (12 ft 0 in)
Wheel track	2.34 m (7 ft 8¼ in)
Float track	2.90 m (9 ft 6¼ in)
Wheelbase	2.845 m (9 ft 4 in)
Propeller diameter	1.93 m (6 ft 4 in)
Propeller ground clearance	1.25 m (4 ft 1¼ in)
Distance between propeller centres	2.80 m (9 ft 2¼ in)
Cabin doors (each): Height	1.10 m (3 ft 7¼ in)
Width: at top	0.75 m (2 ft 5½ in)
at bottom	1.50 m (4 ft 11 in)
Baggage/airdrop door: Height	0.90 m (2 ft 11½ in)
Width: at top	0.85 m (2 ft 9½ in)



Avia Accord 201 second prototype

1159715



Avia Accord-201, showing position of retracted floats in nose and side views (Paul Jackson)

0079325

at bottom	1.20 m (3 ft 11¼ in)
DIMENSIONS, INTERNAL:	
Cabin: Length	3.50 m (11 ft 5¾ in)
Max width	1.31 m (4 ft 3½ in)
Max height	1.20 m (3 ft 11¼ in)
Floor area	3.50 m² (37.7 sq ft)
Volume	4.0 m³ (141 cu ft)
Baggage hold volume:	
pilot and six passengers	0.50 m³ (17.7 cu ft)
pilot and four passengers	1.5 m³ (53 cu ft)
pilot and cargo	2.5 m³ (88 cu ft)
AREAS:	
Wings, gross	17.00 m² (183.0 sq ft)
Ailerons (total)	1.17 m² (12.59 sq ft)
Trailing-edge flaps (total)	3.23 m² (34.77 sq ft)
Fins (total)	1.36 m² (14.64 sq ft)
Rudders (total)	1.36 m² (14.64 sq ft)
Tailplane	2.18 m² (23.47 sq ft)
Elevators (total)	1.78 m² (19.16 sq ft)
WEIGHTS AND LOADINGS:	
Operating weight empty: landplane	1,350 kg (2,976 lb)
amphibian	1,530 kg (3,373 lb)
Max T-O weight	2,200 kg (4,850 lb)
Max wing loading	129.4 kg/m² (26.51 lb/sq ft)
Max power loading	7.03 kg/kW (11.55 lb/hp)
PERFORMANCE (estimated):	
Never-exceed speed (VNE)	202 kt (375 km/h; 233 mph)
Max level speed at S/L:	
landplane	161 kt (299 km/h; 186 mph)
amphibian	150 kt (277 km/h; 172 mph)
Max cruising speed at 75% power at 1,000 m (3,280 ft):	
landplane	148 kt (275 km/h; 170 mph)
amphibian	138 kt (255 km/h; 158 mph)
Econ cruising speed at 3,000 m (9,840 ft):	
landplane	119 kt (220 km/h; 137 mph)
amphibian	111 kt (205 km/h; 127 mph)
Stalling speed, flaps down, power off:	
landplane	58 kt (106 km/h; 66 mph)
Max rate of climb at S/L:	
landplane	445 m (1,460 ft)/min
amphibian	420 m (1,378 ft)/min
Service ceiling: landplane	6,100 m (20,020 ft)
amphibian	5,800 m (19,020 ft)
T-O run:	
on land: landplane	240 m (790 ft)
amphibian	250 m (820 ft)
on water	360 m (1,185 ft)
Landing run on land:	
landplane, amphibian	220 m (725 ft)
on water	190 m (625 ft)
Range with max fuel at 3,000 m (9,840 ft):	
landplane	1,592 n miles (2,950 km; 1,833 miles)
amphibian	1,339 n miles (2,480 km; 1,541 miles)
g limits	+3.8/-1.6

AVIACOR

AVIAKOR AVIATIONNOYE ZAVOD OAO (AVIACOR AVIATION DEPOT JSC)

ulitsa Pskovskaya 32, 443052 Samara
Tel: (+7 8462) 92 66 55
Fax: (+7 8462) 55 07 07
e-mail: gsg@aviacor.ru
Web: www.aviacor.ru
GENERAL DIRECTOR: Sergey K Likharev
MARKETING DIRECTOR: Aleksey V Gusev

Founded in Voronezh during the 1930s and evacuated to Kuybishev (Samara) during Second World War, Aviacor (formerly GAZ 18) has built 22,100 aircraft of 19 versions and 23 subvariants, including Il-2, Tu-4 Tu-95, Tu-114 and Tu-154 three-turboprop transport. In early 2006 it had three Tu-154Ms nearing completion for customers and a further six in early stages of assembly. One Tu-154M completed in late 2005 was for Russian Federation Security Service. It has manufactured the Molniya-1 six-seat light aircraft and an air cushion vehicle derivative, and will produce the Tupolev Tu-354, if ordered. In late 2005 17 Molniya-1

airframes remained in storage because of delays in transferring production of upgraded version to Smolensk plant in wake of restructuring at Molniya and loss of its light aircraft design department. It was also earmarked to build the Ukrainian Antonov An-70 and An-140 in Russia and to assist RSK 'MiG' with the Tu-334. The first An-140-100 (of six in initial batch) was rescheduled for construction in first quarter of 2002, but detailed discussions on a production timetable and contracts for delivery were not held with Antonov until 5 December 2001. First aircraft was eventually rolled out on 25 December 2003, having to wait until 2 August 2005 for first flight. Marketing is by International Aviation Project 140 (MAP-140), which formed 15 September 2003 as joint venture with Inter-AMI (subsidiary of KhGAP at Kharkov).

It was announced in September 2001 that An-70 assembly had been reallocated to Polyot because of Aviacor's inability to provide start-up funding. Subsidiary businesses are Aviacor-Service and Aviacor Repair. Company overhauls Tu-95MS strategic bombers and Tu-154 airliners (11 in 2004) including VIP conversions; makes Tu-154 spares; repaints Il-76s; supports An-72 and An-24. Group members employ Westernised form of company name in place of direct transliteration, Aviakor.

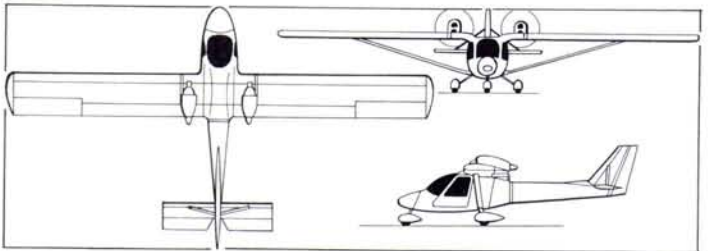
Russian government shareholding is 25.5 per cent; controlling interest held by Siberian Aluminium Group (Sibal) since 1998. Undertakes subcontract work for Airbus and Boeing.

AVIAPROM

AVIAPROMSERVIS

ul Sharikopodshipnikovskaya 4, 115088 Moskva
Tel/Fax: (+7 095) 677 14 91 and 16 58
e-mail: info@aviakom.ru
Web: www.aviakom.ru
GENERAL DIRECTOR: Sergey Fateev
SALES MANAGER: Aleksandr Lisovsky

AviaPromServis formed in 2001 as supplier of spares and equipment to CIS and rest of world notably in airliner galleys and freight pallets, and ground servicing equipment. Formed partnership with Promaks in December 2004 to market M-12 three-seat light twin.



AviaProm M-12 three-seat light twin (James Goulding)

1133723

ACCOMMODATION: Pilot (front) and two passengers (rear). Baggage compartment behind seats. Forward-hinged door each side. Optional second set of controls for port rear seat. Cockpit heated and ventilated.

SYSTEMS: Electric system 12 V and 24 V provided by engine-mounted generators and 55 Ah motorcar battery, plus 9 Ah auxiliary battery.

AVIONICS:

Comms: Garmin GNS 400 nav/com and GTX 320 transponder.

EQUIPMENT: Optional ballistic recovery parachute occupying part of baggage compartment.

DIMENSIONS, EXTERNAL:

Wing span	10.20 m (33 ft 5½ in)
Wing chord, constant	1.20 m (3 ft 11¼ in)
Wing aspect ratio	8.5
Width, wings folded	1.95 m (6 ft 4¾ in)
Length overall	6.80 m (22 ft 3¾ in)
Height overall	2.30 m (7 ft 6½ in)
Tailplane span	3.00 m (9 ft 10 in)
Wheel track	1.60 m (5 ft 3 in)
Wheelbase	2.05 m (6 ft 8¾ in)
Propeller diameter: Rotax 582	1.60 m (5 ft 3 in)
Jabiru 2200, Rotax 912	1.55 m (5 ft 1 in)

DIMENSIONS, INTERNAL:

Cockpit: Length	2.76 m (9 ft 0½ in)
Max width	1.15 m (3 ft 9¼ in)
Max height	1.14 m (3 ft 9 in)

AREAS:

Wings, gross	12.20 m² (131.3 sq ft)
--------------	------------------------

WEIGHTS AND LOADINGS:

Weight empty: Rotax 912	474 kg (1,045 lb)
Jabiru 2200	448 kg (988 lb)
Max baggage weight: normal	40 kg (88 lb)
with BRS parachute	24 kg (53 lb)
Max payload	280 kg (617 lb)
Max fuel weight	108 kg (238 lb)
Max T-O weight: Rotax 912	860 kg (1,895 lb)
Jabiru 2200	848 kg (1,869 lb)
Max zero-fuel weight, Jabiru 2200	750 kg (1,653 lb)
Max wing loading: Rotax 912	70.5 kg/m² (14.44 lb/sq ft)
Jabiru 2200	69.5 kg/m² (14.24 lb/sq ft)
Max power loading: Rotax 912	7.22 kg/kW (11.86 lb/hp)
Jabiru 2200	7.11 kg/kW (11.68 lb/hp)

PERFORMANCE:

Max level speed: Rotax 912	127 kt (235 km/h; 146 mph)
Jabiru 2200	124 kt (230 km/h; 143 mph)
Normal cruising speed: Rotax 912	103 kt (190 km/h; 118 mph)
Jabiru 2200	97 kt (180 km/h; 112 mph)
Max rate of climb at S/L	480 m (1,575 ft)/min
Service ceiling	4,000 m (13,120 ft)
Range with max payload: Rotax 912	637 n miles (1,180 km; 733 miles)
Jabiru 2200	518 n miles (960 km; 596 miles)
Endurance: Rotax 912	6 h 20 min



AviaProm M-12 three-seat lightplane (Paul Jackson)

1158271

AVIASTAR

AVIASTAR, ULYANOVSKY AVIATIONNOYE PROMYSHLENNYI KOMPLEKS OAO (ULYANOVSK AVIATION INDUSTRIAL COMPLEX 'AVIASTAR' JSC)

prospekt Antonova 1, 432072 Ulyanovsk
Tel: (+7 8422) 20 25 75 and 29 10 22
Fax: (+7 8422) 20 35 06 and 29 23 65
e-mail: director@aviastar.link-ul.ru

Web: http://www.aviastar-sp.ru

DIRECTOR GENERAL: V V Mikhailov

CHIEF ENGINEER: Sergey F Milyukov

MARKETING DIRECTOR: Valery D Sherstyanov

Founded on 10 June 1976, this 1.5 million m² (16.5 million sq ft) production facility, known as Plant 25 and named for D F Ustinov, flew its first aircraft, an Antonov An-124 ultra-large airlifter, on 30 October 1985, following with the Tupolev Tu-204 transport in 1987 (first flight 17 August 1990) and the related Tu-234 in 1996. It now takes the style AviaStar-SP. Its biennial production certificate was renewed on 3 November 2004, entitling manufacture of

Tu-204, Tu-204-100, Tu-204-120, Tu-204-120C, Tu-204C and An-124, plus modification of An-124 and upgrade to An-124-100. Tu-204-300 added on 26 May 2005.

In mid-1997, AviaStar agreed to merge with Tupolev design bureau and Aviacor, Tupolev merger effected 30 June 1999, forming Tupolev OAO with inputs from Russian government (51 per cent), AviaStar (43.6 per cent) and Tupolev Design Bureau (5.4 per cent). AviaStar now owned 74 per cent by Tupolev. Under Russian government plans announced on 12 May 2001, AviaStar will be incorporated in major grouping also including RSK 'MiG', Tupolev, Kamov, Aviacor and Sokol. Also in 1997, AviaStar Asia was formed in Taipei, Taiwan, as a joint venture with Asian interests to promote the Tu-204 in the Far East. Finance is provided by AviaStar Financial International, formed by AviaStar, Perm Motors and Moscow International Bank.

After five-year break, production of An-124 resumed with August 2000 delivery of one to Volga-Dniepr, State financing (Rb20 million) was received in 2000 for construction of a second assembly hall for An-124 production; company delivered its 36th and last An-124 in

2004 and was then in consultation with Ukraine regarding resumption of manufacture of An-124-100M version. By late 2001, AviaStar was urgently seeking new financial support to clear its debts. This reportedly achieved in early 2002 when Cato Avomatic (Egypt) and Leader Group (Russia) agreed to fund between 30 and 50 new Tu-204 airframes in 2003–05 initial step being batch of 25 agreed in December 2002. In October 2002, Ilyushin Finance announced intention of ordering 46 Tu-204s over six years; first three confirmed almost immediately. Further orders against these large commitments have been slow in arriving. In September 2003 the plant agreed to accelerate production of five Tu-204s for China, which were required before the end of 2004, these being part of the Cato contract. However, none was completed, although Tu-204/234 No. 38 (35th flyable, AviaStar-built aircraft) first flew 25 November 2004, at which time Nos. 39 and 40 were nearing completion. Schedule for 2005 was four Tu-204s delivered to Vladivostok Avia airline and two to China, fourth Vladivostok machine departed on delivery on 25 December 2005, but no production for China up to that time.

BERIEV

BERIEVA AVIATIONSONNIYI KOMPANIYA (BERIEV AVIATION COMPANY)

ploshchad Aviatorov 1, 347923 Taganrog
Tel: (+7 86344) 499 01 and 498 39

Fax: (+7 86344) 414 54

e-mail: info@beriev.com

Web: www.beriev.com

GENERAL DIRECTOR: Viktor A Kobzev

CHAIRMAN: A I Fyodorov

HEAD OF MARKETING: Andrei Shishko

HEAD OF INFORMATION: Andrei I Salinkov

Original Beriev design bureau (OKB) founded in October 1934 by Georgy Mikhailovich Beriev (1902–79); except during part of the Second World War, 1942–45, it has been based at Taganrog, in northeast corner of Sea of Azov; since 1948 has been primary centre for Russian seaplane development. Beriev has manufactured more than 20 types of aircraft, most of which have entered series production. In 1990 was redesignated Taganrogsky Aviatsonniy Nauchno-Tekhnichesky Kompleks imeni G M Berieva (TANTK: Taganrog Aviation Scientific-Technical Complex named for G M Beriev); became part of AVPK Sukhoi in 1996. As a consequence of this merger, the bureau's products are often manufactured at factories traditionally associated with Sukhoi, the Be-103 Bekas, for example, at Komsomolsk. On 1 January 1998 adopted style, 'Beriev Aviation Company' for international promotion, retaining TANTK in Russia. State shareholding is 38 per cent.

Beriev company now includes the experimental design bureau, experimental production facilities, a flight test complex, economic, financial and logistics support services, with test bases and proving grounds at the Black Sea and Sea of Azov. Its products are experimental prototypes of amphibious aircraft and wing-in-ground-effect (WIG) vehicles, together with test reports and technical documentation for their series production. It undertakes design and development of unconventional aircraft in response to requests for proposals from other companies, testing of aircraft and assemblies in maritime conditions, and training of aircrew and ground personnel for seaplane operation.

Beriev began development of a twin-turboprop, multirole amphibian designated **Be-112** in 1995. The project is, reportedly, still active, although the company declines to publish a likely first flight date. Beriev continues to promote the Be-32K twin-turboprop commuter airliner, A-40 jet flying-boat and Be-12P amphibious water bomber, none of which has immediately obvious production prospects.

BERIEV A-42

Similar to the Beriev A-40, this aircraft project was pursued during the 1990s before being suspended. Prototype 85 per cent complete at TANTK, Taganrog, by September 2000, at which time only Rb19.5 million assigned of Rb307 million required to complete development. By January 2002, Beriev was reporting that this prototype was an A-42P patrol and SAR variant; power plant quoted as two Progress D-27 propfans, each rated at 109.8 kN (24,690 lb st), which description applies to Beriev **A-45**. In this form, A-42P has MTOW of 96,000 kg (211,650 lb), combat load of 8,500 kg (18,739 lb) and range of 6,209 n miles (11,500 km; 7,145 miles). Main sensor suite to be Leninet Novella (Sea Dragon). Domestic needs are up to eight for military use and up to four for MChS civil protection agency; export interest (A-42PEh) from Canada, Chile, China, Finland, South Korea and Thailand. Announced in April 2002 that funding of A-42 to completion would begin in 2005, at earliest, although a September 2003 announcement predicted completion of the first aircraft in 2006. Intended avionics include Sea Snake search and attack radar and Aria-V flight and navigation system. Promotion of A-42 continued into 2006, but with no known signs of progress.

In mid-2002, Beriev was continuing promotion of an A-40Eh export version of the original aircraft as well as predicting a return of official interest to the A-40, which the Russian Navy abandoned in 1996, in favour of a maritime patrol version of Tupolev Tu-204 airliner.

BERIEV Be-101

TYPE: Four-seat amphibian.

PROGRAMME: In November 2005, Beriev disclosed that it was shortly to begin construction at Taganrog of a new light amphibian; first flight was then scheduled for mid-2006 with a public debut at the Gelendzhik air show in September of that year.

DESIGN FEATURES: High wing, with downturned tips acting as water stabilisers, mounted to rear of cabin; pusher propeller; sweptback fin and cruciform tailplane; parallel beam, single-step hull. No dihedral.

FLYING CONTROLS: Conventional and manual. Horn-balanced rudder and elevators; tab in each elevator.

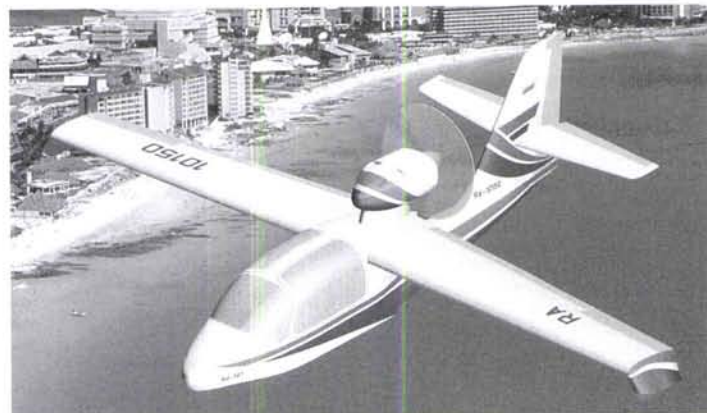
LANDING GEAR: Tricycle type; retractable. Mainwheels stowed in hull sides. Operable in Sea State 2, wave height 0.45 m (1 ft 6 in); maximum required water depth 0.9 m (3 ft).

POWER PLANT: One 231 kW (310 hp) Teledyne Continental IO-550-N flat-six driving an MT-Propeller MTV-12 pusher propeller. Fuel capacity 195 litres (51.5 US gallons; 42.9 Imp gallons).

ACCOMMODATION: Pilot and three passengers in side-by-side pairs. Fixed windscreen, plus upward-hinged door each side. Baggage compartment behind seats.

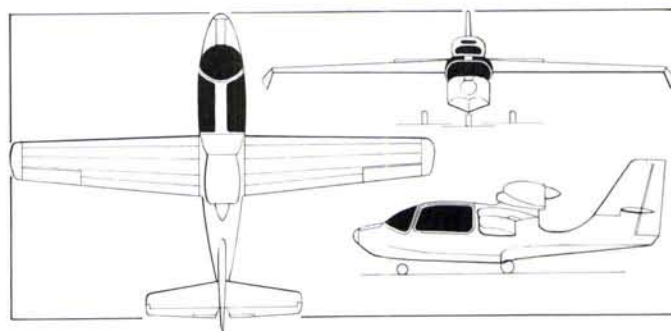
DIMENSIONS, EXTERNAL:

Wing span 12.20 m (40 ft 0¼ in)
Wing aspect ratio 8.9
Length overall 8.90 m (29 ft 2½ in)
Height overall 3.01 m (9 ft 10½ in)



Artist's impression of Beriev Be-101 four-seat amphibian

1128992



Beriev Be-101 amphibian (James Goulding)

1159818

Wheelbase	3.20 m (10 ft 6 in)
Wheel track	2.36 m (7 ft 9 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	2.765 m (9 ft 0¼ in)
Max width	1.28 m (4 ft 2½ in)
Max height	1.30 m (4 ft 3¼ in)
Baggage compartment volume	0.60 m³ (21.2 cu ft)
AREAS:	
Wings, gross	16.675 m² (179.5 sq ft)
WEIGHTS AND LOADINGS:	
Max payload	255 kg (562 lb)
Max fuel weight	140 kg (309 lb)
Max T-O weight	1,450 kg (3,196 lb)
Max wing loading	87.0 kg/m² (17.81 lb/sq ft)
Max power loading	6.27 kg/kW (10.31 lb/hp)
PERFORMANCE (estimated):	
Max level speed at FL98:	151 kt (280 km/h; 174 mph)
Econ cruising speed at FL98	132 kt (245 km/h; 152 mph)
Service ceiling	6,000 m (19,680 ft)
T-O run: land	300 m (985 ft)
water	460 m (1,510 ft)
Landing run: land	190 m (625 ft)
water	380 m (1,250 ft)
Range at FL98, 30 min reserves	540 n miles (1,000 km; 621 miles)

BERIEV Be-103 BEKAS

English name: Snipe

TYPE: Six-seat amphibian.

PROGRAMME: Design started 1992; model exhibited and initial data released at Moscow Air Show '92; construction of preproduction batch of four began by KnaAPO at Komsomolsk-on-Amur 1994; prototype (RA-37019), with M-17F engines, displayed statically at Gelendzhik Hydro-aviation Show, on the Black Sea, 23 September 1996; first flew at Taganrog on 15 July 1997, but destroyed on its 28th sortie, during practice for Moscow Air Show on 18 August 1997. Second prototype (RA-03002) flew 17 November 1997; made type's first water take-off and landing on 24 April 1998 (aircraft's sixth sortie), but crashed on 29 April 1999 while returning from exhibition at Aero '99, Friedrichshafen; further two structure/static test airframes completed for use at Taganrog by early 1997.

Type certification rescheduled for second half of 1998 and first delivery for 1999, but these dates also not met; development being assisted by three preproduction aircraft, which completed by late 1997, although first of these (believed 03101) did not fly until



Beriev Be-103 c/n 3203, one of three which flew from Komsomolsk to St Petersburg in June 2005 1128940

19 February 1999; 03103 shown at Gelendzhik in August 2000 when seen to have fixed wing leading-edge slats outboard of landing lights (as on 03102); by early 2001, 03103 had received nose radome. Total of five flying and two static test aircraft up to this time.

Be-103 development included, since 1997, in Rostov regional development programme, while funding provided by government's 1999–2000 Light Aircraft Development Programme; KnAAPO paid for VFR certification, which granted by Russian Aviation Register on 26 December 2001, after 161 hours of trials, including 59 water and 204 land take-offs, FAR/JAR 23 certification trials satisfactorily completed by April 2003 and confirmation expected to follow.

Marketed by **Takom Avia** consortium, formed by Beriev, KnAAPO and VO Mashinexport of Moscow. In late 1999, consideration given to establishing final assembly centre in Malaysia, combining Russian airframes and US avionics and engines, Aerocorp International, appointed US dealer by 2002. Launch of US certification effort announced in September, but KnAAPO simultaneously revealed temporary suspension of production due to lack of orders. Named **Bekas** in February 2003. First production aircraft (03301) flew 2 July 2003, US certification achieved 11 July 2003 (presented 31 July) and three aircraft air-freighted to Oshkosh by An-124 on 23 July for US distributor, Aerocorp, and immediate US debut at AirVenture '03, first becoming N13KL (03301).

CURRENT VERSIONS: **Be-103**: As described.

SA-20P: Described separately.

OSA: In September 2003, Beriev was reported to be working on design of a Be-103 variant with a single turboprop of between 298 and 373 kW (400 and 500 shp) under the provisional designation *OSA (odnovigatelnyi samolet amfibiya*: single-engined amphibian), of which the SA-20P is regarded as a prototype.

CUSTOMERS: Projected sales of 350 to 450, including exports. Break-even at 250th. First reported order from Russian Border Guards for 20 (out of possible 200 required), originally for delivery from 1999; Forestry Service requires 30 to 40. First export order announced August 1999 in form of 10 for undisclosed customer; however, in January 2002 Beriev was still negotiating first firm orders, comprising possible six for forestry use and others for border patrol. None of these has materialised. By late 2005: five Be-103s operating in Russia, apparently pre-series machines comprising two with Beriev Bureau; two with KnAAPO's own airline; and one with aero club at Kubinka.

Initial production batch of 10; deliveries began July 2003; in form of three to US dealer; second batch of 20 due to have been started by late 2003 and by late 2005, total of 40 in various stages of assembly. Orders then said to be "about 100".

Announced May 2004 that 20 purchased for delivery to China. Chinese certification achieved 22 December 2005, in anticipation of all 20 deliveries in 2006; name, *Albatros* associated with Chinese version. Initial operator will be Flying Dragon airline at Harbin; Sukhoi group to maintain related service centre in China. Brazilian certification obtained 3 August 2005; initial eight required by local MSA Group.

In January 2006, Colombian ambassador to Russia signed framework agreement with KnAAPO plant covering Be-103 deliveries. Indonesian fisheries ministry interested in eight Be-103s, according to December 2005 report, to combat illegal fishing; Singaporean surveillance equipment, possibly including datalink, to be installed. Canadian certification procedure launched May 2005.

COSTS: Basic price USD650,000 (2003), with IO-360 engines. Total operating costs USD81.27 per hour at 600 hr/year (2004).

DESIGN FEATURES: Low-wing monoplane, with water-displacing wings of moderate sweep with large wingroot extensions; two-step boat hull; no stabilising floats; horizontal strake each side of nose, plus vertical strake ahead of second hull step; wing centre-section increases lift during take-off and landing, partly compensating for absence of flaps. Engine pylon mounted on each side of rear fuselage, aft of wings; engines raised slightly on production version. Sweptback fin and rudder; tailplane mid-set on fin. Designed in compliance with AP-23 and FAR Pt 23 requirements; suitable for passenger and cargo transport, medical evacuation, patrol and ecological monitoring. Operable in wave heights up to 0.5 m (1½ ft) and on water as shallow as 1.25 m (4 ft). Service life 15,000 hours or 20 years, including 5,000 water- and 6,000 land landings.

Wing leading-edge sweep 22°; wing section NACA 2412M; dihedral 5° 3' on outer wings; incidence 1°. Fixed leading-edge slats. Fin leading-edge sweep 33°; tailplane 14° 40'.

FLYING CONTROLS: Manual. All-moving tailplane (with anti-balance tab) and ailerons actuated by pushrods; rudder by cables; two mass balances ahead of tailplane; mass balance (port

side only) on rudder, which has flight-adjustable trim tab; electric trim; spring feel in tailplane control; no flaps. Control surface deflections: ailerons ±25°; tailplane +14/–6°; rudder ±27°.

STRUCTURE: All-metal semi-monocoque boat-type fuselage; all-metal single-spar wings. Extensive use of riveted 1446 aluminium-lithium alloy.

LANDING GEAR: Hydraulically retractable tricycle type; single wheel on each unit; mainwheels retract forward into wing centre-section; nosewheel retracts forward; oleo-nitrogen shock-absorbers; brakes on mainwheels; nosewheel tyre size 400×150, pressure 3.92 bar 57 lb/sq in; mainwheel tyres 7.00-6, pressure 3.62 bar (53 lb/sq in); mainwheel disc brakes; self-centring nosewheel steerable ±30°. Turning circle 8.35 m (27 ft 6 in) about nosewheel; 13.55 m (44 ft 6 in) about wingtip.

POWER PLANT: Two 157 kW (210 hp) Teledyne Continental IO-360-ES4 flat-four piston engines, each driving an MT-Propeller MTV-12-D-C-F-R-(M)/CFR183-17 three-blade, variable pitch (hydraulic), metal propeller. Certified for propeller reversal 17 November 2004. Later option will be two 221 kW (296 hp) VAZ-4263 piston engines and Avia AV-103 three-blade, variable-pitch propellers, with optional reversible pitch. Fuel tanks in wingroots, each 136 litres (35.9 US gallons; 29.9 Imp gallons) and in engine pylons, each 35 litres (9.2 US gallons; 7.7 Imp gallons); total 342 litres (90.3 US gallons; 75.2 Imp gallons), of which 316 litres (83.4 US gallons; 69.5 Imp gallons) usable. Oil capacity 8 litres (2.0 US gallons; 1.7 Imp gallons) per engine.

ACCOMMODATION: Pilot and five passengers in pairs; dual controls optional (standard for USA); large upward-opening door on each side, hinged on centreline, starboard side as emergency exit only; folding seats facilitate entry/loading baggage/freight compartment aft of cabin. Optional ambulance configuration for pilot, one stretcher, three seated persons; all-cargo configuration for items up to 2.00 × 0.70 × 0.70 m (6 ft 6¾ in × 2 ft 3½ in × 2 ft 3½ in) in size; patrol; agricultural and ecological monitoring use. Accommodation heated and ventilated.

SYSTEMS: Hydraulic system, capacity 3 litres (6 US pints; 5 Imp pints), pressure 16.1 bar (234 lb/sq in). Electrical system 28.5 V DC, supplied by two 3.4 kW 60 A generators; 17 Ah battery. Fire suppression system. Optional anti-icing.

AVIONICS: Integrated by Bendix/King, VFR standard; IFR optional. Version with Russian avionics may be offered in the future.

Comms: KY 196A VHF com radio, KMA 24 intercom, KX 165 nav/com/glideslope, KT 70 transponder and P-855 emergency locator beacon.

Radar: Optional RDR-2000 or RDR-1400 weather radar in extreme nose.

Flight: KN 63 DME, KR 87 ADF, KCS 55A compass, KEA 130A encoding altimeter, KLN 89B GPS, Optional AP-103 autopilot.

Instrumentation: Conventional.

EQUIPMENT: Landing light in each wing leading-edge.

DIMENSIONS, EXTERNAL:

Wing span	12.72 m (41 ft 9 in)
Wing chord: at root	6.21 m (20 ft 4¾ in)
at tip	0.83 m (2 ft 9 in)
Wing aspect ratio	6.4
Length: overall, no radar	10.65 m (34 ft 11¼ in)
overall with radar	10.875 m (35 ft 8¼ in)
Fuselage	9.96 m (32 ft 8 in)
Fuselage max width	1.35 m (4 ft 5¼ in)
Height overall	3.76 m (12 ft 4 in)
Tailplane span	3.90 m (12 ft 9½ in)
Wheel track	2.275 m (7 ft 5½ in)
Wheelbase	4.065 m (13 ft 4 in)
Propeller diameter	1.83 m (6 ft 0 in)
Distance between propeller centres	3.00 m (9 ft 10¼ in)
Passenger door/emergency exit (both): Height	0.80 m (2 ft 7½ in)
Width	1.40 m (4 ft 7 in)

DIMENSIONS, INTERNAL:

Cabin: Length	3.38 m (11 ft 1 in)
Max width	1.25 m (4 ft 1¼ in)
Max height	1.23 m (4 ft 0½ in)
Floor area	4.05 m² (43.6 sq ft)
Volume	4.6 m³ (162 cu ft)
Baggage compartment: Max width	1.08 m (3 ft 6½ in)
Max height	0.88 m (2 ft 10½ in)
Floor area	0.91 m² (9.8 sq ft)
Volume	0.85 m³ (30.0 cu ft)

AREAS:

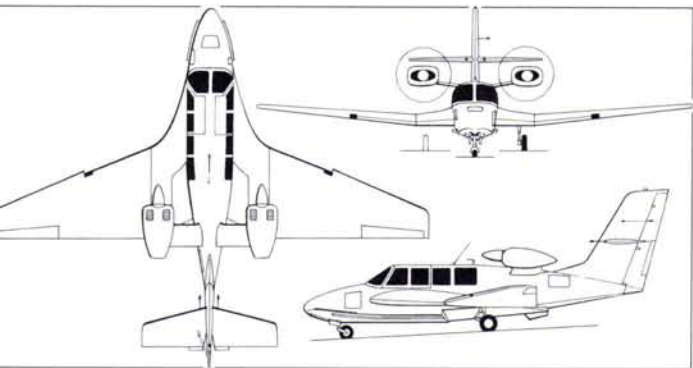
Wings, gross	25.10 m² (270.2 sq ft)
Ailerons, total	0.80 m² (8.61 sq ft)
Fin	2.86 m² (30.78 sq ft)
Rudder	1.54 m² (16.58 sq ft)
Tailplane, total	3.68 m² (39.61 sq ft)

WEIGHTS AND LOADINGS:

Manufacturer's empty weight	1,680 kg (3,703 lb)
Weight empty, equipped	1,834 kg (4,041 lb)
Operational weight	1,902 kg (4,193 lb)
Baggage capacity	50 kg (110 lb)
Payload with max fuel	123 kg (271 lb)
Max fuel weight	245 kg (540 lb)
Max T-O and landing weight	2,270 kg (5,004 lb)
Max ramp weight	2,280 kg (5,026 lb)
Max zero-fuel weight	2,219 kg (4,892 lb)
Max wing loading	90.4 kg/m² (18.52 lb/sq ft)
Max power loading	7.25 kg/kW (11.91 lb/hp)

PERFORMANCE(US version):

Never-exceed speed (VNE)	130 kt (240 km/h; 149 mph)
Max cruising speed at FL98	130 kt (240 km/h; 149 mph)
Econ cruising speed at FL98	108 kt (200 km/h; 124 mph)
Stalling speed	59 kt (109 km/h; 68 mph)
Single-engine minimum control speed	62 kt (115 km/h; 71 mph)
Max rate of climb at S/L	312 m (1,024 ft)/min
Service ceiling	5,020 m (16,460 ft)
Operational ceiling	3,000 m (9,840 ft)
T-O run: on land	350 m (1,150 ft)
on water	560 m (1,840 ft)
T-O to 15 m (50 ft): on land	460 m (1,510 ft)
on water	850 m (2,790 ft)
Landing from 9 m (30 ft): on land	650 m (2,135 ft)
on water	770 m (2,530 ft)



Beriev Be-103 Bekas twin-engined light multipurpose amphibian (Mike Keep) 0132839

Landing run: on land	400 m (1,315 ft)
on water	360 m (1,185 ft)
Range, with max fuel:	
at 500 m (1,640 ft)	637 n miles (1,180 km; 733 miles)
at FL98	594 n miles (1,100 km; 683 miles)
Endurance, no reserves	6 h 30 min
g limits	+3.45/-1.45

BERIEV (KNAAPO) SA-20P OSA

English name: Wasp

TYPE: Six-seat amphibian.

PROGRAMME: Developed by KnaAPO at Komsomolsk as single-engined version of Beriev Be-103 Bekas for Russian Federation market. First aircraft under construction at KnaAPO by September 2001, when designation first announced. Prototype exhibited unflown at Gelendzhik Hidroavia Salon, September 2002. First flight 16 October 2002. Factory trials had been completed by April 2003; certification to Russian AP-23 and FAR Pt 23 due 2003, for first deliveries in 2004, although this timetable not met. Prototype transferred to KnaAPO Sports & Technical Club for experimental service. Reported in 2004 to be undergoing redesign to eliminate buffeting. By early 2006 no production aircraft had been reported, although prototype (by then registered RA-3068K) had completed at least 100 sorties, although only 28 hours.

CURRENT VERSIONS: **SA-20P:** As described.

Turboprop: Under study by 2005 with 373 kW (500 hp) version of Progress AI-450 turboprop in pusher configuration on central cabane. Power plant weight saving of 220 to 250 kg (485 to 551 lb) permits addition of two extra seats (pilot and seven passengers); 20 per cent reduction in water take-off run; and increase of operating ceiling to 8,000 m (26,240 ft). MTOW unchanged, but empty weight 1,540 kg (3,395 lb) and 460 kg (1,014 lb) fuel load, giving 734 n mile (1,360 km; 845 mile) range plus 30 minutes, or 324 n miles (600 km; 372 miles) with five passengers and same reserves. Max level speed 146 kt (270 km/h; 168 mph); cruising speed 113 kt (210 km/h; 130 mph); and 61 kt (112 km/h; 70 mph) stall. T-O run 245 m (805 ft) on land and 400 m (1,315 ft) on water.

Data generally as for Be-103, except that below.

COSTS: USD500,000 (2003).

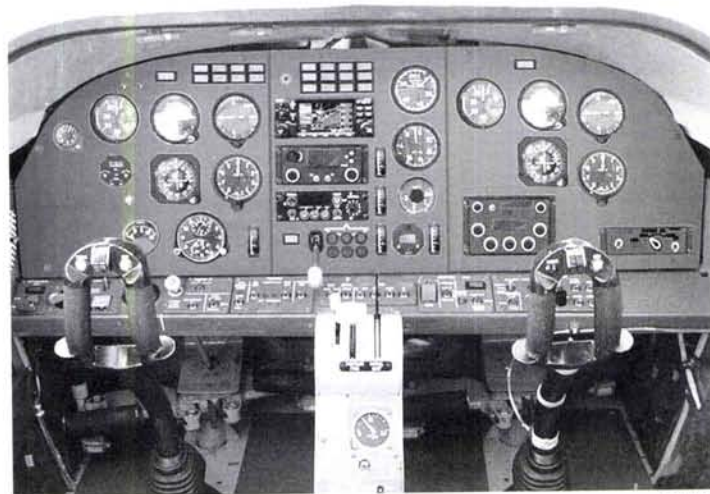
DESIGN FEATURES: Single engine mounted in cabane above fuselage. Service life 12,000 hours or 15 years.

FLYING CONTROLS: Conventional horizontal tail surfaces (tailplane and separate elevator).



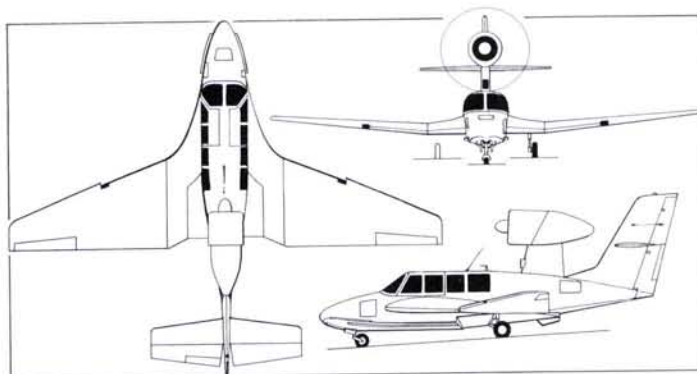
Beriev (KnaAPO) SA-20P single-engined amphibian

0576864



Beriev (KnaAPO) SA-20P instrument panel

1128941



Beriev (KnaAPO) SA-20P Osa (Mike Keep)

1046497

POWER PLANT: One 265 kW (355 hp) VOKBM M-14P nine-cylinder radial engine.

DIMENSIONS, EXTERNAL:

Length overall	10.45 m (34 ft 3½ in)
Height overall	3.75 m (12 ft 3¼ in)

WEIGHTS AND LOADINGS:

Weight empty	1,670 kg (3,682 lb)
Max payload	400 kg (882 lb)
Max fuel weight	216 kg (476 lb)
Max T-O weight	2,270 kg (5,004 lb)
Max wing loading	90.4 kg/m² (18.52 lb/sq ft)
Max power loading	8.58 kg/kW (14.10 lb/hp)

PERFORMANCE:

Max level speed	113 kt (210 km/h; 130 mph)
Cruising speed	97 kt (180 km/h; 112 mph)
Service ceiling	4,700 m (15,420 ft)
T-O run: on land	300 m (985 ft)
on water	600 m (1,970 ft)

Range, 30 min reserves:

with max fuel	486 n miles (900 km; 559 miles)
with max payload	216 n miles (400 km; 248 miles)

BERIEV Be-112

TYPE: Twin-turboprop amphibian.

PROGRAMME: First details revealed in early 2006; no development/production timetable disclosed.

DESIGN FEATURES: Optimised for both passenger and cargo carrying, with emphasis on opening new air routes to remote locations. Slightly sweptback wings with moderate anhedral mounted on fuselage shoulders; wingtip floats. Barrelled hull cross-section with large sponsons for water stability. Twin, outward-canted fins supporting single-piece tailplane; engine attached to leading-edge of each fin. Rear cargo ramp between fins. Operable in wave heights up to 0.8 m (2 ft 6 in).

FLYING CONTROLS: Conventional and manual. Single-piece elevator with large tab; inset rudder, with tab, in each fin; tab in each aileron. Slotted flaps.

LANDING GEAR: Tailwheel type; retractable. Twin wheels on each main leg retract into sponsons.

POWER PLANT: Two turboprops. Option of 1,044 kW (1,400 shp) RKBM TVD-1500 or 1,062 kW (1,424 shp) Pratt & Whitney Canada PT6A-67R.

ACCOMMODATION: Nominal seating for 27 passengers at 80 cm (31½ in) pitch; combi interior for cargo, including vehicles loaded via rear ramp.

DIMENSIONS, EXTERNAL:

Wing span	21.20 m (69 ft 6¾ in)
Length overall	17.00 m (55 ft 9¼ in)
Height overall	5.20 m (17 ft 0¾ in)
Wheelbase	8.65 m (28 ft 4½ in)
Wheel track	4.50 m (14 ft 9¼ in)

DIMENSIONS, INTERNAL:

Cabin: Length	10.20 m (33 ft 5½ in)
Max width	2.15 m (7 ft 0¾ in)
Max height	1.84 m (6 ft 0½ in)

WEIGHTS AND LOADINGS:

Max payload	2,350 kg (5,181 lb)
Max T-O weight	11,000 kg (24,250 lb)
Max power loading: TVD-1500	5.27 kg/kW (8.66 lb/shp)
PT6A-67R	5.18 kg/kW (8.51 lb/shp)

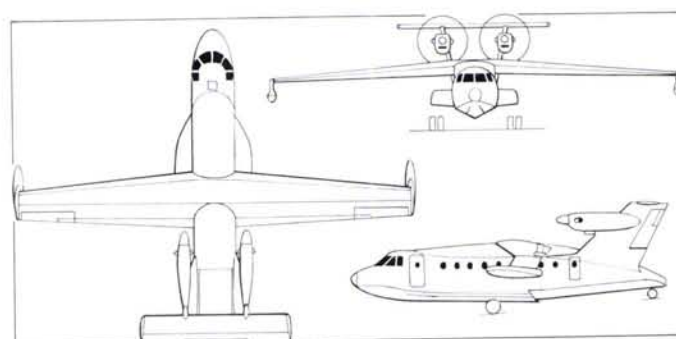
PERFORMANCE (estimated):

Max level speed at FL98	226 kt (420 km/h; 261 mph)
Econ cruising speed at FL98	200 kt (370 km/h; 230 mph)
Max certified altitude	7,600 m (24,940 ft)



Artist's impression of Beriev Be-112 twin-turboprop utility amphibian

1128991



Beriev Be-112 amphibious twin (James Goulding)

1159819

T-O run: land 850 m (2,790 ft)
water 860 m (2,825 ft)
Landing run, water 515 m (1,690 ft)
Range with 2,100 kg (4,630 lb) payload at FL98, 30 min reserves 540 n miles (1,000 km; 621 miles)

BERIEV (BETAIR) Be-200 ALTAIR

TYPE: Twin-jet amphibian.
PROGRAMME:

DEVELOPMENT MILESTONES

Design began	1989
Announced	Jun 91
Official go-ahead	8 Dec 90
Rollled out	11 Sep 96
First flight	24 Sep 98
Official first flight	17 Oct 98
Public debut	13 Jun 99
First flight, production	17 Jun 03
Certification	29 Dec 03
First delivery (MChS)	31 Jul 03
Entered service (MChS)	21 Jun 04

Initiated 1989 under design leadership of Alexander Yavkin. Russian government approval for purpose-designed water bomber granted 8 December 1990. Details announced, and model displayed, at 1991 Paris Air Show: full-scale mockup constructed 1991; development by Beta Air (Betair: Beriev taganrog Irkutsk) consortium, formed 27 November 1991 from Irkutsk Aircraft Production Association (53.5 per cent), Beriev OKB (20.5 per cent), ILTA Trade Finance SA of Geneva, Switzerland (5 per cent) and the Ukrainian bank Prominvest (15 per cent) plus unidentified partner(s) (6 per cent); included in Civil Aviation Development Programme and state forestry protection programme. Named Altair in February 2002.

Beriev responsible for development, design and documentation; systems bench-testing; static-, flight- and fatigue-testing of prototypes; certification and design support of serial production. Irkut duties comprise production preparation; manufacture of tooling; production of four prototypes and series aircraft; and spare parts manufacture. In May 2002, EADS signed joint marketing agreement with IAPCO. Initial production and certification supported by Alenia of Italy under USD1.6 million programme financed by European Union. In March 2003, agreement reached on transfer of production to Beriev plant at Taganrog and in following June, EADS, Rolls-Royce Deutschland and Irkut study revealed potential market for 320 BR715-engined Altairs over 20 years, leading to decision to launch this variant.

First prototype (001) rolled out 11 September 1996, at Irkutsk; first flight scheduled 1997, but eventually achieved (from land) 24 September 1998; 'official' first flight 17 October 1998; aircraft transferred from Irkutsk to Taganrog (by then with 19 sorties and 26½ flying hours) on 27 April 1999 to begin certification trials, including water drops; exhibited at Paris (by then registered RA-21511) June 1999; first water landings and take-offs, 10 September 1999. Total 80 sorties, including 18 from water, by November 1999, when water operations ceased for winter. Experimental category certification achieved March 2000. Awarded limited category AP-25 certification for firefighting operations 10 August 2001, by which time had flown 337 sorties (100 from water) and achieved 202 flying hours. Second phase of testing begun October 2001 to certify patrol and passenger operations using BR715 engines, although most of that month occupied by a nine-country Far East sales tour. Prototype had accumulated 650 hours in nearly 600 sorties (216 from water) by May 2002. Demonstrated on Lake Sevan, Armenia, 15 August 2002; set six FAI climb-with-payload records in hydroplane class, 7 September 2002.

Second flying prototype (003) in firefighting configuration (Be-200ChS). Two test airframes, of which first ferried from Irkutsk to Taganrog by An-124 in March 1995, followed by second in 1997; these, respectively, static test (SI: *staticheskii ispytaniya*) and fatigue test (RI: *resursnye ispytaniya*). Four production aircraft (0101 to 0104) in hand by



Beriev Be-200 Altair during Italian contract in mid-2005; Bombardier 415 water bomber behind 1128944

late 1998; fifth was taking shape in early 2002. On original schedule, second prototype was due for delivery in late 1999 to Russian Emergency Ministry. Repeated delays resulted in first flight (003/RA-21512) on 27 August 2002, following which it was exhibited at Gelendzhik Hidroavia Salon, 4 to 8 September 2002. Firefighting contract in Italy between 6 July and 17 September 2005 involving 63 sorties (including positioning), 435 scoops and drops totalling 3,500 tonnes, and 150 hours of flying.

First production aircraft (0101/RA-21515) rolled out 26 May and first flew 17 June 2003; Be-200 restricted type certificate issued by Interstate Aviation Committee on 20 June 2003; RA-21515 delivered to MChS 31 July 2003 and based at Zhukovsky, taking part in MAKS '03 air show in following month. Full certificate issued 29 December 2003. Second production aircraft (0102/RA-32516) began land taxiing trials on 26 February 2004 and delivered 26 May 2004. Zhukovsky detachment declared operational 21 June 2004. Third delivery (0201/RA-32517; first with IAI/Tamam AOS TV/IR sensor) effected 15 July 2005 (later re-registered RA-32767) and further pairs due in both 2006 and 2007 for total of seven. Initial two machines upgraded to full standard with some 300 modifications, first being redelivered on 1 April 2005.

Avionics development and scoop trials for water bomber version being undertaken by the Beriev Be-12P-200/Be-128 testbed since August 1996. TANTK also produced four Be-12Ps (*Pozharnyye*: firefighting) for concept and tactics development and two Be-12NKh (*Narodno-Khozyaystvennyye*: National Economy) general purpose versions, both of which lost in 1994.

CURRENT VERSIONS: **Firefighting:** TsENTROSPAS/MChS designation **Be-200ChS**: Tanks under cabin floor of centre-fuselage, capacity 12 m³ (423 cu ft) water; six tanks in cabin for 1.2 m³ (42 cu ft) liquid chemicals; two retractable water scoops forward of step, two aft; 30 fully equipped smoke jumpers can be carried on seats along sidewalls of cabin, with jump-door at rear of cabin on starboard side; 12 tonnes of water scooped from seas in 14 seconds at speeds up to 103 kt (190 km/h; 118 mph).

Fully fuelled, Be-200 can drop total 310,000 kg (683,420 lb) of water in successive flights when airfield to reservoir distance is 108 n miles (200 km; 125 miles) and reservoir to fire zone distance is 5.4 n miles (10 km; 6.2 miles); or 140,000 kg (308,640 lb) when distances are respectively 108 n miles (200 km; 125 miles) and 27 n miles (50 km; 31 miles). Tank emptying time 0.8 to 1.0 second; average dropping speed 119 kt (220 km/h; 137 mph); minimum height 50 m (165 ft). Tanks quickly removable when aircraft carries freight. Flight deck and cargo hold sealed against smoke ingress. ARIA-200M avionics features include water source/drop zone track memory, automatic glideslope and digital flight deck/ground fire crew communications. Also outfitted for SAR, with equipment including Orion 25S inflatable boat, naval radios, 600 W loudspeaker and searchlight, storage for 20 inflatable rafts and two four-seat motorboats, observer's station, 57 seats and attachment for 30 litters.

In 2004, Irkut was promoting a firefighting package of Be-200 assisted by fire reconnaissance Aeronautics Aerostar UAV supplied by Israeli manufacturer.

Cargo: Payload 7,500 kg (16,534 lb) in unobstructed cabin 17.00 m (55 ft 9 in) long, 2.6 m (8 ft 6 in) wide and 1.9 m (6 ft 3 in) high accommodating nine PA 1.5 pallets or seven LD3 containers.

Ambulance: Two flight crew, seven seated casualties/medical personnel, intensive care equipment and 30 stretchers in three tiers.

Patrol: Paramilitary version for possible use of Russian Frontier Guards revealed to be under development in early 2002.

Be-200PS: Search and rescue. Provisions included in Be-200ChS described above. Able to loiter for 6 h 30 min at up to 200 n miles (370 km; 230 miles) from base.

Be-200M: Redesignated Be-210 in 1998.

Be-200P: Projected anti-submarine version; combat radius 2,537 n miles (4,700 km; 2,920 miles); endurance 7 hours.

Be-210: Announced in 1998; development of Be-200 multirole amphibian for airline use in regions of minimal airport infrastructure. Seating for two pilots, two attendants and 72 passengers at 75 cm (29½ in) seat pitch. Other details may be assumed to be similar to Be-200, but airframe strengthened for extra fuel in wing centre-section (42,000 kg; 92,594 lb MTOW) and ferry range increased to 2,483 n miles (4,600 km; 2,858 miles), or 998 n miles (1,850 km; 1,149 miles) with full passenger load.

Be-220: Maritime patrol version offered in 2006 to China and India. Novella (Sea Dragon) detection systems and extended nose radome.

Be-250: Airborne early-warning and control version; first reported as 2006 project. Refuelling probe; sensors scabbled to fuselage shoulders.

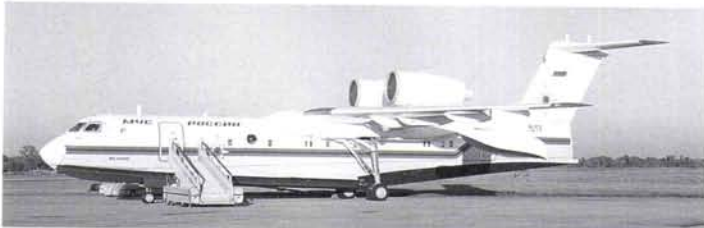
CUSTOMERS: Seven ordered (of 20 required) by TsENTROSPAS/MChS (Russian Ministry of Emergency Situations) on 15 January 1997 for firefighting, with further orders to follow for SAR: decision in principle to acquire eighth, funded by cancellation of proposed two Antonov An74s. However, at time of maiden flight, only five orders were being claimed as firm. Will equip four SAR stations on Black Sea and Baltic and two in eastern Russia; first base was to have been Gelendzhik where two Altairs (0101 and 0102) scheduled to be in service by end of 2003. Beriev contracted in 2002 to establish training school at Taganrog for MChS pilots and technicians. However Zhukovsky (Ramenskoye) nominated as central base for MChS Altair fleet.

Russian state forest service/firefighting agency requires up to 54, of which near-term needs total 10 to 15; 50 required by Sakhalin regional administration; five by Irkutsk regional administration.

Potential market foreseen for more than 400 by 2010, of which over 60 per cent for export. South Korea evinced interest in 12 of maritime patrol version for police duties during 1998; China considering licensed production at Harbin; Italian interest in 15 reported mid-2000. Australia, France, Indonesia, Japan and Philippines expressing interest in 2001–02 and Be-200 demonstrated at Marseilles, France, 13 to 15 May 2002, and at Elefsis, Greece. Hawkins & Powers of USA negotiating for eight in early 2004. Croatian plans to acquire two announced 15 August 2004.

COSTS: Basic price USD25 million (2000). Break-even at 46/48th aircraft. Development cost estimated as USD250 million, of which USD190 million expended by 2001.

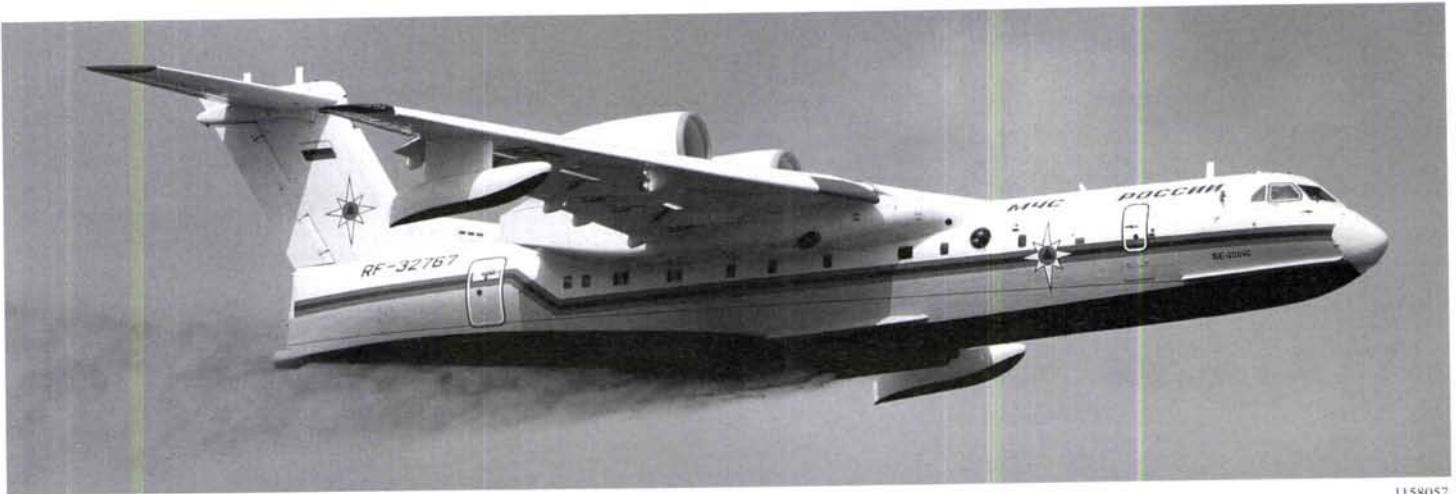
DESIGN FEATURES: First Russian purpose-designed water-bomber. Derived from Beriev A-40, but underwing stabilising floats moved inboard from tips, twin-wheel main landing gear units, and no booster turbojets. Conforms to FAR Pt 25 criteria. Swept wings of moderate



Third Beriev Be-200ChS (RF-32517) delivered to MChS Rossii emergencies ministry with original registration (Yefim Gordon) 1128942



Passenger cabin of Beriev Be-200 Altair used for personnel transport 1128943



Beriev Be-200ChS (RF-32767) exhibited at ILA, Berlin, in May 2006 (Paul Jackson)

1158057

aspect ratio, with high-lift devices; single-step hull of high length/beam ratio, which reported to provide world's first variable-rise bottom, providing a considerable improvement in stability and controllability in the water, as well as a reduction in g loads when landing and taking off at sea; small wedge-shape boxes ('hydrodynamic compensators') aft of step aid 'unsticking' from water in wave heights up to 1.2 m (4 ft); required draught 2.6 m (8 ft 6 in); all-swept T tail; high-mounted engines protected from spray by strakes on each side of nose and by wings; large underwing pod each side of hull, faired into wingroot.

Wing leading-edge sweep 23° 13'; supercritical wing sections, thickness/chord ratio 16 per cent to 11.5 per cent.

FLYING CONTROLS: Fly-by-wire. Entire span of each wing trailing-edge occupied by aileron and two-section area-increasing single-slotted flaps; full-span leading-edge slats in three sections each side; five spoiler/lift dumper sections forward of flaps each side.

STRUCTURE: Hull made primarily of high-strength aluminium/lithium alloys; interior of composites; water tanks of ferric alloys of aluminium in firefighting version.

LANDING GEAR: Hydraulically retractable tricycle type. Twin-wheel main units, tyre size 950x300, pressure 9.80 to 10.30 bar (142 to 150 lb/sq in); twin nosewheels, tyre size 620x180, pressure 7.35 to 7.85 bar (106 to 114 lb/sq in). Mainwheels and nosewheels retract rearwards. Water rudder. Ground turning radius 17.4 m (57 ft 1 in). Nosewheel steering angle ±45°.

POWER PLANT: Two ZMKB Progress D-436TP turboprops, each 73.6 kN (16,550 lb st). Rolls-Royce BR715s and others under consideration as alternative engines, but late 2004 study concluded market for R-R version would not cover development costs. Fuel system by Pall (USA). Total oil capacity 22 litres (5.8 US gallons; 4.85 Imp gallons).

ACCOMMODATION: Two flight crew; up to 72 tourist class passengers at 75 cm (29.5 in) seat pitch and two attendants; or 10 to 32 first class and business class passengers at up to 102 cm (40 in) seat pitch, with provision for galley, lavatory and baggage stowage. Up to nine freight containers or, typically, six containers and 19 economy class seats. Cargo door, with integral passenger door, starboard side, forward, opens upwards; passenger door port, forward; emergency exits; forward and rear freight/baggage holds. Interior design by AIM Aviation (UK).

SYSTEMS: MRPC Avionika EDSU-200 electronic flight control system (FBW). Barco Display Systems FMS system. All accommodation pressurised. Three hydraulic systems at 207 bar (3,000 lb/sq in); 150 litres (39.6 US gallons; 33.0 Imp gallons) of MGJ-5U fluid; flow rate 70 litres (18.5 US gallons; 15.4 Imp gallons)/min. Capacity of pneumatic system bottles 29 litres (1.02 cu ft). Three-phase 115/220 V 400 Hz AC electrical system; single-phase 115 V 400 Hz AC system; 27 V DC system; supplied by two engine-driven 60 kVA AC generators and three static inverters; three batteries. Gaseous oxygen bottle, pressure 147 bar (2,135 lb/sq in). Provision for de-icing tail unit, slats, engine air intakes and windscreen. TA-12 APU, operable up to 7,000 m (23,000 ft) in starboard wingroot. Propeller-driven emergency generator at base of fin.

AVIONICS: Radar: MN-85 weather radar in nose.

Flight: ARIA-200M digital flight and navigation system by American-Russian Integrated Avionics, a joint venture of AlliedSignal (now Honeywell) and Moscow Research Institute of Aircraft Equipment. INS standard.

Instrumentation: Honeywell EFIS displays, with six 152 × 203 mm (6 × 8 in) LCDs.

Mission: Optional IAI/Tamam AOS (airborne observation system) turret mounted in flap actuator fairing under port wing provides TV and IR imagery for SAR, fire patrol and ecological monitoring missions. Prototype installation April 2005.

DIMENSIONS, EXTERNAL:

Wing span over winglets	32.78 m (107 ft 6½ in)
Wing chord: at root	5.58 m (18 ft 3½ in)
at tip	1.72 m (5 ft 7¾ in)
Wing aspect ratio	9.1
Length overall	31.43 m (103 ft 1½ in)
Fuselage: Length	29.18 m (95 ft 9 in)
Max diameter	2.86 m (9 ft 4½ in)
Height overall	8.90 m (29 ft 2½ in)
Tailplane span	10.115 m (33 ft 2¼ in)
Wheel track (c/l shock-absorbers)	4.30 m (14 ft 1¼ in)
Wheelbase	11.145 m (36 ft 6¾ in)
Width over stabilising floats	25.60 m (84 ft 0 in)
Passenger doors (each): Height	1.70 m (5 ft 7 in)
Width	0.90 m (2 ft 11½ in)
Cargo door: Height	1.76 m (5 ft 9¼ in)
Width	2.05 m (6 ft 8¾ in)
Emergency exits: Height	1.70 m (5 ft 7 in)
Width	0.90 m (2 ft 11½ in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck:	17.00 m (55 ft 9 in)
Length: passenger	18.70 m (61 ft 4¼ in)
cargo	2.40 m (7 ft 10½ in)
Max width: passenger	2.50 m (8 ft 2½ in)
cargo	1.80 m (5 ft 10¾ in)
Max height: passenger	1.89 m (6 ft 2½ in)
cargo	39.0 m² (420 sq ft)
Floor area: passenger	41.0 m² (441 sq ft)
cargo	8.8 m³ (310 cu ft)
Volume:	4.5 m³ (159 cu ft)
passenger:	
forward baggage hold	8.8 m³ (310 cu ft)
rear baggage hold	4.5 m³ (159 cu ft)
main cabin and freight/baggage holds, total, cargo configuration	84.0 m³ (2,966 cu ft)
cargo	80.8 m³ (2,853 cu ft)

AREAS:

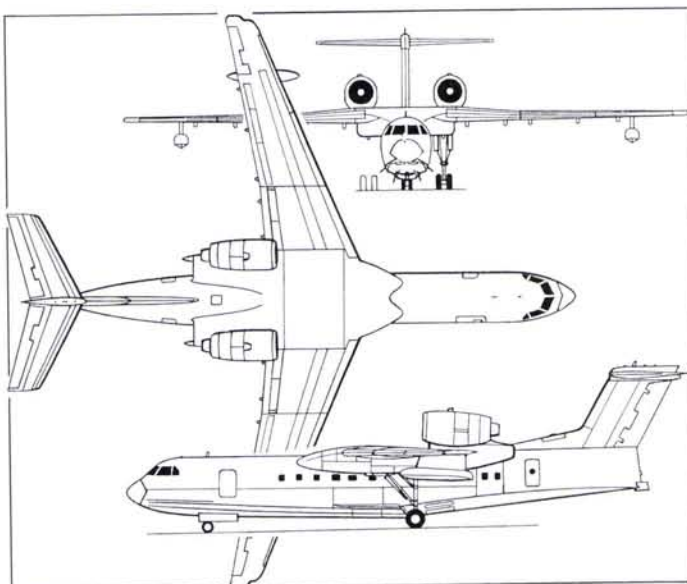
Wings, gross	117.44 m² (1,264.2 sq ft)
Ailerons (total)	3.56 m² (38.32 sq ft)
Flaps (total)	20.43 m² (219.91 sq ft)
Slats (total)	12.61 m² (135.74 sq ft)
Spoilers (total)	4.59 m² (49.41 sq ft)
Fin	12.60 m² (135.63 sq ft)
Rudder	4.60 m² (49.52 sq ft)
Tailplane	17.96 m² (193.33 sq ft)
Elevators (total)	6.96 m² (74.92 sq ft)

WEIGHTS AND LOADINGS:

Max payload as freighter	7,500 kg (16,534 lb)
Weight empty: firefighting	27,600 kg (60,848 lb)
Max fuel weight	12,260 kg (27,025 lb)
Max T-O and ramp weight:	
from land	41,000 kg (90,389 lb)
from water	38,000 kg (83,775 lb)
Max airborne weight (after water scooping)	43,000 kg (94,800 lb)
Max wing loading:	
firefighting	349.1 kg/m² (71.50 lb/sq ft)
max airborne weight	366.1 kg/m² (74.99 lb/sq ft)
Max power loading:	
firefighting	278 kg/kN (2.73 lb/lb st)
max airborne weight	292 kg/kN (2.86 lb/lb st)

PERFORMANCE:

Max Mach No, in level flight	0.69
Never-exceed speed (VNE):	329 kt (610 km/h; 379 mph) EAS
Max level speed at FL230	388 kt (720 km/h; 447 mph)
Max cruising speed	
at FL262	378 kt (700 km/h; 435 mph)
Econ cruising speed at FL262	302 kt (560 km/h; 348 mph)
Stalling speed: flaps up	116 kt (215 km/h; 134 mph)
flaps down	84 kt (155 km/h; 97 mph)
Max rate of climb at S/L: at MTOW	840 m (2,755 ft)/min
at water scooping weight	570 m (1,870 ft)/min
Rate of climb at S/L, OEI	168 m (550 ft)/min



Beriev (Betair) Be-200 Altair civil utility amphibian (Mike Keep)

1158061

Max certified altitude	8,000 m (26,240 ft)
Service ceiling, OEI	5,500 m (18,040 ft)
T-O to 11 m (35 ft):	
on land	1,270 m (4,170 ft)
on water	1,000 m (3,280 ft)
Landing from 15 m (50 ft):	
on land	1,020 m (3,350 ft)
on water	1,300 m (4,265 ft)
Water scooping distance to 15 m (50 ft)	1,450 m (4,760 ft)
Range with 1 h reserves:	

with max freight	540 n miles (1,000 km; 621 miles)
C, D with 6,500 kg (14,330 lb) freight, 1 h reserves	
ferry	675 n miles (1,250 km; 776 miles)
absolute	1,781 n miles (3,300 km; 2,050 miles)
absolute	2,078 n miles (3,850 km; 2,392 miles)

OPERATIONAL NOISE LEVELS:

T-O	96 EPNdB
Climb	90 EPNdB
Landing	98 EPNdB

CHERNOV

OPYTNYI KONSTRUKTORSKOYE BYURO CHERNOV B & M OOO
(B & M CHERNOV EXPERIMENTAL DESIGN BUREAU JSC)

Tel: (+8 8462) 37 24 25
e-mail: chernovb@samaramail.ru
Web: www.sama.ru/~chernovb

The designs of Boris V Chernov have previously been associated with the No.1 Students' Design Bureau (SKB-1) at Samara. However, in August 1999, the Che-25 amphibian was shown at MAKS '99, credited to Chernov's own design office. The earlier Che-22 is now produced by Gidroplan and has also been built under licence in Vietnam, while the single-engine Che-23 has recently been completed. Other designs have been the Che-10 (1986), Che-15, Che-20 (1989) and Che-30 (1991), while Chernov was also associated with the Delta flex-wing and Albatros surface-skimmer. Work is currently in hand to design the Che-35 twin-engined flying-boat.



Che-30 prototype, a previous creation of Boris Chernov

0137984

CHERNOV Che-23

TYPE: Two-seat amphibian.	
PROGRAMME: First flown July 2003.	
DESIGN FEATURES: Generally as Gidroplan Che-22.	
FLYING CONTROLS: Manual.	
STRUCTURE: Predominantly of metal.	
LANDING GEAR: Optional amphibian configuration. Tailwheel/water rudder immediately to rear of second hull step.	
POWER PLANT: One 47.8 kW (64.1 hp) Rotax 582 UL two-cylinder piston engine driving three-bladed propeller. Optionally, one 73.5 kW (98.6 hp) Rotax 912 ULS.	
DIMENSIONS, EXTERNAL:	
Wing span	11.00 m (36 ft 1 in)
Length overall	6.50 m (21 ft 4 in)
Height overall: Rotax 582	2.50 m (8 ft 2½ in)
Rotax 912	2.40 m (7 ft 10½ in)
WEIGHTS AND LOADINGS:	
Weight empty: Rotax 582	295 kg (650 lb)
Rotax 912	310 kg (683 lb)
Max T-O weight	570 kg (1,256 lb)
PERFORMANCE:	
Max level speed	81 kt (150 km/h; 93 mph)
Normal cruising speed	65 kt (120 km/h; 75 mph)
Stalling speed	30 kt (55 km/h; 35 mph)
Max rate of climb at S/L	150 m (492 ft)/min



Chernov Che-23

1159716

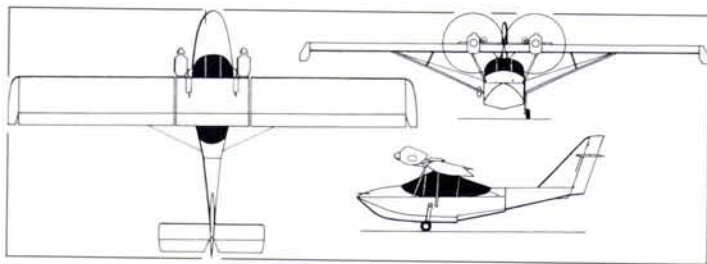
CHERNOV Che-25

TYPE: Four-seat amphibian.
PROGRAMME: First flown 1995. Development of Che-22 Corvette, which is now produced by Gidroplan. Prototype (FLARF-17039), built by students' design bureau SKB-1 and first



Chernov Che-25 moored

1159717



General arrangement of the Che-25 (Paul Jackson)

shown at Gelendzhik Hydro-aviation Show, Russia, September 1996. Che-25M shown at MAKS '99, Moscow, had redesigned empennage with raised tailplane and deletion of rudder's horn balance.

CURRENT VERSIONS: **Che-25:** As described.

BD-205: Shown at Aerospace China, Zhuhai, November 2004, marked in Roman ('BD'). a Chinese version marketed by Harbin Institute of Technology (BaDa Aviation Industry Co).

COSTS: USD44,000 (1997).

DESIGN FEATURES: Generally as Che-22. Operable on water in 0.8 m (30 in) swell.

FLYING CONTROLS: Manual, with full-span slotted flaperons. No tabs.

STRUCTURE: Single-spar wing of riveted duralumin; fuselage, tail unit and wingtip floats of vacuum-moulded GFRP sandwich. Wings braced by struts and wires; strut-braced tailplane. Airframe life 3,000 hours.

LANDING GEAR: Optional amphibian configuration; mainwheel legs, attached to fuselage sides, turn 90° forward for retraction; mainwheel tyre size 300x125; tailskid; cable brakes. Tailwheel/water rudder immediately to rear of second hull step.

POWER PLANT: Two 47.8 kW (64.1 hp) Rotax 582 UL-2V two-cylinder piston engines driving two-blade fixed-pitch propellers. Fuel capacity 130 litres (34.3 US gallons; 28.6 Imp gallons). Version, planned with Rotax 912 ULS of 73.5 kW (98.6 hp) and Subaru EA-71.

ACCOMMODATION: Four persons; dual controls. Gull-wing door each side of cockpit.

DIMENSIONS, EXTERNAL:

Wing span	12.60 m (41 ft 4 in)
Wing chord, constant	1.40 m (4 ft 7¼ in)
Wing aspect ratio	8.4
Length overall	7.70 m (25 ft 3¼ in)
Height overall (on wheels, fuselage horizontal)	2.50 m (8 ft 2½ in)
Tailplane span	2.80 m (9 ft 2¼ in)
Wheel track (optional)	1.42 m (4 ft 8 in)
Propeller diameter	1.84 m (6 ft 0½ in)
Distance between propeller centres	1.84 m (6 ft 0½ in)

AREAS:

Wings, gross	16.38 m ² (176.3 sq ft)
--------------------	------------------------------------

WEIGHTS AND LOADINGS:

Weight empty	590 kg (1,301 lb)
Max payload	300 kg (661 lb)
Max T-O weight	1,150 kg (2,535 lb)
Max wing loading	70.2 kg/m ² (14.38 lb/sq ft)
Max power loading	12.03 kg/kW (19.77 lb/hp)

PERFORMANCE:

Max level speed	97 kt (180 km/h; 112 mph)
Max cruising speed	76 kt (140 km/h; 87 mph)
Unstick speed	38 kt (70 km/h; 44 mph)
Max rate of climb at S/L	300 m (984 ft)/min
Service ceiling	4,000 m (13,120 ft)
T-O run: on land	100 m (330 ft)
on water	70 m (230 ft)
Range	405 n miles (750 km; 466 miles)
g limits	+4/-2

CHERNOV Che-27

TYPE: Five-seat amphibian.

PROGRAMME: First flown 2003.

DESIGN FEATURES: Practically identical to Che-25M but with seating for five.

FLYING CONTROLS: Manual.

STRUCTURE: Predominantly of metal.

LANDING GEAR: Optional amphibian configuration. Tailwheel/water rudder immediately to rear of second hull step.

POWER PLANT: Two 47.8 kW (64.1 hp) Rotax 582 U.I. two-cylinder piston engines, each driving a three-blade propeller. Optionally, two 73.5 kW (98.6 hp) Rotax 912 U.I.S.

DIMENSIONS, EXTERNAL:

Wing span 12.60 m (41 ft 4 in)
 Length overall 7.70 m (25 ft 3¼ in)
 Height overall 2.50 m (8 ft 2½ in)

AREAS:

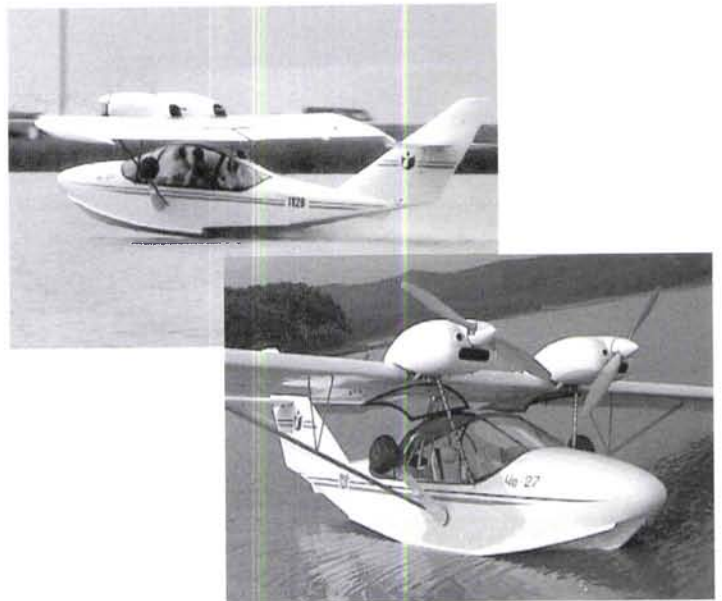
Wings, gross 16.38 m² (176.3 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 590 kg (1,301 lb)
 Max T-O weight 1,150 kg (2,535 lb)
 Max wing loading 70.2 kg/m² (14.38 lb/sq ft)
 Max power loading 12.03 kg/kW (19.76 lb/hp)

PERFORMANCE:

Max level speed 97 kt (180 km/h; 112 mph)
 Normal cruising speed 76 kt (140 km/h; 87 mph)
 Stalling speed 38 kt (70 km/h; 44 mph)
 Max rate of climb at S/L 150 m (492 ft)/min
 T-O run: on land 100 m (330 ft)
 on water 70 m (230 ft)
 Range 405 n miles (750 km; 466 miles)
 g limits +4/-2



Views of Chernov Che-27

1159721

DUBNA (DMZ)

**PROIZVODSTVENNO-TEKHNICHESKY KOMPLEKS
 DUBNENSKOGO MASHINOSTROITELNOGO ZAVOD AO
 (DUBNA MACHINE-BUILDING PLANT PRODUCTION TECHNICAL
 COMPLEX CO LTD)**

ulitsa Zhukovskogo 2, 141980 Dubna, Moskovskaya oblast

Tel: (+7 09621) 515 21

Fax: (+7 09621) 232 99

e-mail: dmz@dubna.ru

Web: www.dmz.ru

GENERAL DIRECTOR: Aleksey Saushkin

Founded on 10 July 1939, the Dubna Plant is an enterprise of the General Department of Aircraft Industry of the State Committee on Defence Industries of the Russian Federation. In the 1960s, it launched airframe production of the MiG-25 fighter and became a major producer of missiles for Eastern bloc and other countries. As part of its restructuring under the *Konversiya* policy, since reorganisation on current lines in 1994, it has produced components for the Sukhoi Su-29 two-seat aerobatic aircraft and developed the Dubna-1/2 series of light aircraft. Two Su-29 fuselages were built in 2000.

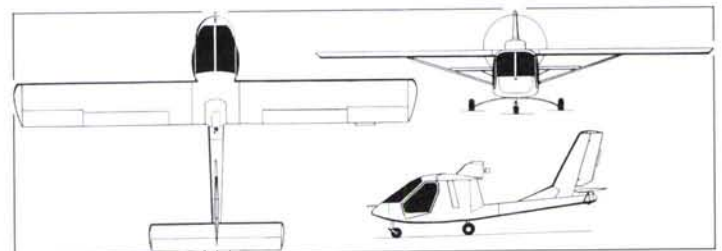
The single-seat Dubna-1 Shmel was similar to the current Osa. Dubna has an agreement to build light aircraft designed by MKB Raduga, whose precision-guided weapons are also manufactured by DMZ. By early 2004, there had been no further reports of the proposed Dubna-4 Raduga four-seat, twin-engine lightplane, although a **Dubna-M** four-seater was reportedly nearing completion in late 2006, powered by a 93.2 kW (125 hp) Subaru piston engine and resembling a Dubna-2 with modified wing, plus 0.33 m (13 in) fuselage stretch. The company had some 1,000 employees in early 2002 and is 60 per cent owned by the State. Other products include the AVP air cushion vehicle, satellite antennae, fabric treatment machines, cardboard box making machines and equipment for filling metal cans.

DUBNA-2 OSA

English name: Wasp

TYPE: Two-seat lightplane.

PROGRAMME: Designed by Taifun Experimental Design Bureau as DMZ-2; prototype (FLARF-01325) displayed at Moscow Air Show '95 and '97 with 59.6 kW (79.9 hp) Rotax 912 engine and two-blade propeller; promoted in China, 1996. By 1999, when definitive



Dubna-2 Osa (Paul Jackson)

(K092552)

Dubna-2M FLARF-01268 shown at Moscow, detail changes included increased wheel track; repositioning of landing gear leg to below fuselage and of wing bracing strut to further forward. This aircraft had 89.5 kW (120 hp) Hirth F30/4C engine and 80 litre (21.1 US gallon; 17.6 Imp gallon) fuel tank, whereas standard Dubna-2M equipped with Rotax 912 U.I.S. Type had not received certification by end of 2004 and little appeared to have changed 12 months later.

CUSTOMERS: Total 11 Dubna-2s, 10 Dubna-2Ms and one Hirth-engined prototype built by late 2004, including two in that year to United Arab Emirates and one each to Bulgaria and Greece; others to Saratov and Orenburg regional governments of Russia in agricultural spraying configuration. By early 2004, no confirmation that these deliveries had taken place, although it was reported in June 2004 that a follow-on batch of Dubna-2s was in the early stages of assembly.

COSTS: USD32,000 (2002).

DESIGN FEATURES: Pod-and-boom configuration, with strut-braced, constant-chord high wing, pusher propeller and sweptback fin with small fillet. Suitable for passenger, freight and mail transport, crop-spraying, forest surveillance, oil/gas pipeline and power line patrol, coastal fishery survey, aerial photography, *ab initio* pilot training and special missions.

FLYING CONTROLS: Conventional and manual. Flight-adjustable tab on elevator; ground-adjustable tabs on starboard aileron and rudder.

STRUCTURE: As Dubna-1.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring metal mainwheel legs; trailing-link nosewheel leg. Tyres size 400x150 mm on mainwheels, 310x135 mm on nosewheel. Floats (**Dubna-2P**) and skis optional.



Dubna-2A Osa two-seat multipurpose light aircraft (Paul Jackson)

(K092528)

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS flat-four driving three-blade pusher propeller. Fuel tank behind cabin, capacity 70 litres (18.5 US gallons; 15.4 Imp gallons).

ACCOMMODATION: Two seats side by side, with dual controls, in fully enclosed, extensively glazed cabin; forward-hinged window/door on each side; space for baggage/freight in compartment behind cabin.

DIMENSIONS, EXTERNAL:

Wing span	9.92 m (32 ft 6½ in)
Wing aspect ratio	9.0
Length overall	5.97 m (19 ft 7 in)
Width over doors	1.25 m (4 ft 1¼ in)
Height overall	2.91 m (9 ft 6½ in)
Tailplane span	3.30 m (10 ft 10 in)
Wheel track	2.40 m (7 ft 10½ in)
Wheelbase	1.90 m (6 ft 2½ in)

AREAS:

Wings, gross	10.92 m ² (117.5 sq ft)
--------------	------------------------------------

WEIGHTS AND LOADINGS:

Weight empty	296 kg (653 lb)
Baggage capacity	30 kg (66 lb)
Max T-O weight	576 kg (1,270 lb)

ELITAR

VVV-AVIA

Volokolamskoye shosse 4, 125993 Moskva

Tel: (+7 095) 959 74 50

GENERAL DIRECTOR: Viktor A Tarhov

WORKS:

A-4, Smyshliaevka Airport, 443046 Samara

Tel: (+7 846) 226 06 31 and 226 17 87

Fax: (+7 846) 226 05 41

e-mail: elitar-avia@mail.ru

Web: www.vvv-avia.ru

DESIGN BUREAU:

Ehlitar — 101 OOO, Korp 2, ulitsa B Cheremushkinskaya, 117448 Moskva

GENERAL DIRECTOR: Aleksey B Kondratyev

MANAGER: Igor Bezrodnov

At the August 1999 MAKES air show, Ehlitar (which adopts the Western form, Elitar and was formed in 1997) displayed the newly flown IE-101 high wing lightplane and released initial details of the low-wing IE-201 Senator.

In addition to these light aircraft, Elitar was also developing at that time the E-301 and E-401 high-wing, twin-engined light transports, seating four to five and nine persons, respectively. A four-seat business 'triplane', the Premier, has been under design since 2000.

At Moscow in August 2003, Elitar unveiled the 202 and also displayed the previously known Sigma-4, formerly credited to the Albatros bureau. Company announcements have also mentioned the IE-203 floatplane project.

Members of the Elitar design and production team work for MiG, Molniya and Sukhoi design bureaux and have been responsible for the M-5 Oktyabr and M-9 Marafon ultralights.

Manufacturing of at least some Elitar designs was originally assigned to VVV-Avia, but by 2003 this company appeared to have formed a subsidiary at Samara, known as ZEVS-Avia, specifically to produce the Elitar-202 and Sigma. In 2005, company announced that it had appointed Sportsplanes.com as North American agent for Sigma. The earlier '101 and '201 seem no longer to be promoted.

ELITAR-202

TYPE: Two-seat lightplane.

PROGRAMME: First shown at MAKES '03, Moscow, August 2003. Built by Samara ZEVS-Avia at Samara. Certification then expected in November 2003 but no evidence that this has occurred.

CUSTOMERS: Ten built and 12 more on order by August 2003; company foresees market for 600 aircraft in Russia and will produce up to 25 per month, depending on demand.

COSTS: USD60,000 (2004).

Max wing loading	52.7 kg/m ² (10.81 lb/sq ft)
Max power loading	9.60 kg/kW (15.88 lb/hp)

PERFORMANCE (Hirth engine):

Max level speed	89 kt (165 km/h; 102 mph)
Nominal cruising speed	62 kt (115 km/h; 71 mph)
Landing speed	41 kt (75 km/h; 47 mph)
Unstick speed	46 kt (85 km/h; 53 mph)
Max rate of climb at S/L	240 m (790 ft)/min
Service ceiling	4,000 m (13,120 ft)
T-O run	120 m (395 ft)
Max range	270 n miles (500 km; 310 miles)
g limits	+4.0/-2.5

DUBNA-4

TYPE: Four-seat utility twin.

PROGRAMME: Designed by MKB Raduga; based on Dubna-2; completion of prototype planned for 2002, but no announcement known by early 2003. Optimised for use by Ministry of Emergency Situations and Forestry Service.

COSTS: Estimated US\$55,000 to US\$58,000 (2002).

DESIGN FEATURES: Low-wing cabin monoplane of composites construction, optimised for high cruising speed and long range; constant-chord, cantilever mainplanes; sweptback fin with underfin.

LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring metal cantilever mainwheel legs with wheel fairings. Trailing-link nosewheel.

POWER PLANT: One 73.5 kW (98.6 hp) Rotax 912 ULS flat-four. Fuel capacity 110 litres (29.0 US gallons; 24.2 Imp gallons).

DIMENSIONS, EXTERNAL:

Wing span	8.30 m (27 ft 2¾ in)
Length overall	5.80 m (19 ft 0¼ in)
Height overall	2.10 m (6 ft 10¾ in)

AREAS:

Wings area, gross	9.10 m ² (98.0 sq ft)
-------------------	----------------------------------

WEIGHTS AND LOADINGS:

Weight empty	476 kg (1,049 lb)
Max T-O weight	730 kg (1,609 lb)
Max wing loading	80.2 kg/m ² (16.43 lb/sq ft)
Max power loading	9.93 kg/kW (16.32 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	146 kt (270 km/h; 168 mph)
Max level speed	130 kt (240 km/h; 149 mph)
Normal cruising speed	108 kt (200 km/h; 124 mph)
Econ cruising speed	81 kt (150 km/h; 93 mph)
Stalling speed: flaps up	63 kt (115 km/h; 72 mph)
flaps down	57 kt (105 km/h; 66 mph)
Max rate of climb at S/L	270 m (886 ft)/min
Service ceiling	3,000 m (9,840 ft)
T-O run	220 m (722 ft)
T-O to 15 m (50 ft)	620 m (2,035 ft)
Landing from 15 m (50 ft)	600 m (1,970 ft)
Landing run	180 m (590 ft)
Range	432 n miles (800 km; 497 miles)
g limits	+3.8/-1.9

ELITAR SIGMA-4

TYPE: Side-by-side ultralight.

PROGRAMME: Originated in Albatros design bureau at Zhukovsky; built at Samara. Marketed by Elitar (VVV Avia) from 2003; eighth airframe became first produced under VVV Avia and US demonstrator, 2005; has since achieved LSA compliance.

CUSTOMERS: One aircraft noted with LII experimental department at Zhukovsky, Moscow region; another with Sebastopol Aero Club, Ukraine. Nos. 10 to 12 delivered to New Zealand as kits in 2005.

COSTS: USD55,000 basic, flyaway; USD85,000 with all options; LSA USD79,000 (2006).



Elitar-202 on show at MAKES '03 (Sebastian Zacharias)

0567691



Elitar Sigma-4 US demonstrator (Paul Jackson)

1159746

DESIGN FEATURES: Wing-and-boom configuration, with underslung crew pod braced to wings by single streamlined strut each side. Small underfin.
FLYING CONTROLS: Conventional and manual.
STRUCTURE: Metal frame with composites skin.
LANDING GEAR: Tricycle type; fixed. Fuselage-mounted spring cantilever mainwheel legs. Horizontal spring cantilever nosewheel leg with castoring wheel.
POWER PLANT: One 75.3 kW (98.6 hp) Rotax 912 ULS flat-four mounted above and ahead of the pod, driving a three-blade propeller. Fuel capacity 65 litres (17.2 US gallons; 14.3 Imp gallons).

ACCOMMODATION: Pilot and passenger side-by-side. Folding throttle control fitted to port side for flying from left-hand seat.
EQUIPMENT: Ballistic recovery parachute standard in Russia.
DIMENSIONS, EXTERNAL:
Wing span 9.80 m (32 ft 13/4 in)
Length overall 6.20 m (20 ft 4 in)
Height overall 2.90 m (9 ft 6 in)
DIMENSIONS, INTERNAL:
Cabin max width 1.22 m (4 ft 0 in)
AREAS:
Wings, gross 10.90 m² (117.3 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 340 kg (750 lb)
Max T-O weight: Normal 540 kg (1,190 lb)
LSA 598 kg (1,320 lb)
PERFORMANCE:
Max level speed 113 kt (210 km/h; 130 mph)
Cruising speed 122 kt (170 km/h; 106 mph)
Stalling speed 50 kt (70 km/h; 44 mph)
Max rate of climb at S/L 360 m (1,181 ft)/min
T-O run 100 m (330 ft)
Landing run 132 m (435 ft)
Range 378 n miles (700 km; 435 miles)

GIDROPLAN

GIDROPLAN 000 (HYDROPLANE LTD)

18 km, Moskovskoye Shosse, Litera A, A1, Samara 443072

Tel (1): (+7 8462) 53 90 19

Tel (2): (+7 095) 369 35 66

Fax: (+7 8462) 53 39 38

e-mail 1: hyd@mail.radiant.ru

e-mail 2: hydroplane@smrk.ru

Web: www.hydroplane.ru

EXECUTIVE DIRECTOR: Pavel Piotnitsa

CHIEF DESIGNER: Evgeny Yungorov

Gidroplan Ltd was formed in 1995 and has marketed amphibian lightplanes designed by the Chernov bureau.

This venture was placed on a firmer footing in late 2000 when Gidroplan invested the equivalent of USD500,000 in acquiring 3,500 m² (37,675 sq ft) of working area from the Samara Instrument Bearing Plant and installing production equipment. Manufacturing activities include the Tsikada (Cicada) twin-engined ultralight agricultural aircraft, some six of which were manufactured before production ceased (although it remains available to special order and was shown at Moscow in August 2003) and the Che-22 Corvette amphibian.

In recent years, designers associated with Gidroplan have produced flying prototypes of three lightplanes not promoted outside Russia. These are the **A-17** single-seat ultralight (260 kg; 573 lb MTOW, 22.4 kW; 30 hp engine, believed from SGAU); Chernov **Che-40** flying-boat (two Rotax 582 engines, briefly described in the 1999/2000 edition of *Jane's All the World's Aircraft* and now confirmed to have been built); and **Ultralayt** twin-tailboom ultralight (600 kg; 1,322 lb MTOW, Rotax 912 S) built in 1998 by E Yungorov and S Seleznevym.



Gidroplan Che-22 Korvet-L (Corvette-L), fitted with suspended hydroplane-type wingtip floats (Sebastian Zacharias) 0583379

training and business operations. Quoted build time 1,500 hours, or 50 hours for fast build kit.

Braced parasol monoplane, with light central cabane and single main bracing strut and bracing wire each side; downturned wingtips serve as stabilising floats, but each has suspended miniature float to prevent wingtip contacting water at speed. Flying-boat hull with two steps; unswept strut-braced horizontal tail surfaces mounted on fin of sweptback vertical surfaces; engine(s) mounted on leading-edge of wing centre-section. US demonstrator has fin of reduced height. Unswept constant chord wing; CAH1 (TsAGI) P-III A section, thickness/chord ratio 15 per cent; incidence 4° 30'; dihedral 1° 30'. Airframe life 3,000 flying hours.

FLYING CONTROLS: Conventional and manual, with pushrod actuation. Full-span slotted flaperons, elevators and horn-balanced rudder; fixed tab on port elevator.

STRUCTURE: Single-spar wing of riveted duralumin; fuselage, tail unit and integral wingtip floats of vacuum-moulded GFRP sandwich; flaperons fabric-covered.

LANDING GEAR: Optional amphibian configuration; spring cantilever mainwheel legs, attached to fuselage sides, turn 90° forward for retraction, tyre size 350x120; GFRP skis optional.

POWER PLANT: Two 37 kW (49.6 hp) Rotax 503 UL-2V or two 47.8 kW (64.1 hp) Rotax 582 UL or 59.6 kW (79.9 hp) Rotax 912 UL. Two-blade wooden or three-blade GFRP fixed-pitch propeller(s) of Russian manufacture. Two fuel tanks in wing centre-section, 100 litres (26.4 US gallons; 22.0 Imp gallons); gravity fuelling.

ACCOMMODATION: Pilot and two passengers under large glazed blister canopy, giving exceptional field of view. Detachable windscreen panels. Gull-wing canopy/door each side.

SYSTEMS: 12/24 V electrical system.

AVIONICS: *Comms:* VHF radios.

Flight: Garmin GPS.

EQUIPMENT: Optional BRS parachute.

DIMENSIONS, EXTERNAL:
Wing span 10.53 m (34 ft 6 1/2 in)
Wing chord, constant 1.40 m (4 ft 7 1/4 in)
Wing aspect ratio 6.8
Length overall 7.25 m (23 ft 9 1/2 in)
Height overall 2.40 m (7 ft 10 1/2 in)
Tailplane span 2.50 m (8 ft 2 1/2 in)
Wheel track 2.00 m (6 ft 6 3/4 in)
Wheelbase 4.55 m (14 ft 11 in)
Propeller diameter 1.50 m (4 ft 11 in)
Canopy doors (each): Height 0.70 m (2 ft 3 1/2 in)
Width 0.80 m (2 ft 7 1/2 in)
Height to sill 0.63 m (2 ft 0 3/4 in)

DIMENSIONS, INTERNAL:
Cabin: Length 1.50 m (4 ft 11 in)
Max width 1.10 m (3 ft 7 1/4 in)
Max height 1.20 m (3 ft 11 1/4 in)

AREAS:
Wings, gross 16.40 m² (176.5 sq ft)

GIDROPLAN Che-22 KORVET

English name: Corvette

US marketing name: Pelican

TYPE: Three-seat amphibian/kitbuilt.

PROGRAMME: Developed on basis of four earlier amateur-built, Vikhr-engined Che-20s, winners of many light aircraft competitions; design and construction of prototype started 1988, first flight 1989; construction of production aircraft started 1992, first flight 1993; more than 5,000 hours of test and training flights, and more than 120 amateur pilots trained on prototype and production aircraft in first five years. Promotion also undertaken by Refly of St Petersburg; launched as Refly Pelican at EAA AirVenture, Oshkosh, 2000, but no further US promotion known and Gidroplan has disassociated itself from Refly.

Upgraded version under development and certification during 2001 features cantilever wing, strengthened tail unit with increased rudder area, new control system, redesigned engine support and modified instrument panel; flight testing was completed at the end of 2001 and Russian certification was awarded on 26 December 2001, followed by JAR/FAR Pt 23 certification in early 2002.

CURRENT VERSIONS: **Corvette 503:** With two Rotax 503 UL two-cylinder two-stroke engines.

Corvette 582: With two Rotax 582 UL two-cylinder two-stroke engines.

Corvette 912: With one Rotax 912 UL four-cylinder four-stroke engine.

Corvette-L: Shown at Moscow in 2003. Miniature floats suspended from main wingtip floats.

Refly Pelican: Generally as for Corvette 582. Production not authorised by Gidroplan.

CUSTOMERS: First preproduction delivery to a forest control organisation 1990. One (Che-22R-2 c/n 006, RP-X1548 of OVOS W.L. Co) sold in Philippines. Others to China, Spain and Vietnam. Total 60 built by February 2002, including 10 in 2000. First Pelican in US (N27NS, ex-RA-02777) registered in March 2001.

COSTS: Standard aircraft USD35,000 to USD55,000 (2002).

DESIGN FEATURES: Designed to JAR-VLA, FAR Pt 23 and AP-23 requirements, for maximum simplicity of design and construction; primarily for forestry applications, but suitable for patrol, inspection and ecological monitoring of hunting and fishing locations, border patrol.

For details of the latest updates to *Jane's All the World's Aircraft* online and to discover the additional information available exclusively to online subscribers please visit
jawa.janes.com

Flaperons (total)	3.40 m ² (36.60 sq ft)
Fin	0.55 m ² (5.92 sq ft)
Rudder	0.35 m ² (3.77 sq ft)
Tailplane	1.68 m ² (18.08 sq ft)
Elevators (total)	0.80 m ² (8.61 sq ft)
WEIGHTS AND LOADINGS (A: Corvette 503, B: Corvette 582, C: Corvette 912):	
Weight empty: A, B, C	380 to 480 kg (838 to 1,058 lb)
Max fuel: A, B, C	58 kg (128 lb)
Max T-O weight: A, B, C	675 kg (1,488 lb)
Max wing loading: A	21.95 kg/m ² (4.50 lb/sq ft)
C	29.27 kg/m ² (5.99 lb/sq ft)
Max power loading: A	4.86 kg/kW (7.99 lb/hp)
C	8.05 kg/kW (13.23 lb/hp)
PERFORMANCE:	
Max level speed: A	81 kt (150 km/h; 93 mph)
B, C	86 kt (160 km/h; 99 mph)
Cruising speed: A	65 kt (120 km/h; 75 mph)
B, C	70 kt (130 km/h; 81 mph)

Max rate of climb at S/L: A	300 m (985 ft)/min
B	420 m (1,378 ft)/min
C	240 m (787 ft)/min
Service ceiling: A, B, C	3,000 m (9,840 ft)
T-O run: on land: A	90 m (295 ft)
B	80 m (263 ft)
C	110 m (361 ft)
on water: A	110 m (361 ft)
B	90 m (295 ft)
C	120 m (394 ft)
Range with standard fuel:	
A	232 n miles (430 km; 267 miles)
B	243 n miles (450 km; 279 miles)
C	324 n miles (600 km; 372 miles)
g limits	+3.8/-1.5
Permissible wave height: A, B, C	0.5 m (1 ft 7 3/4 in)

GRIFFON

GRIFFON AERO
ulitsa Volokolamskaya 74a, Dedovsk, Moskovskaya oblast
Tel: (+7 916) 677 90 77
e-mail: griffon-aero@narod.ru
Web: www.griffon-aero.narod.ru

Griffon was established by a group of aviation enthusiasts who are members of the FLARF group.

GRIFFON 100

TYPE: Two-seat lightplane.
PROGRAMME: At 2005 Moscow Salon, Griffon Aero displayed a light aircraft closely resembling the Zenith STOL CH 701, available in two fuselage lengths and with a variety of engine options.
CURRENT VERSIONS: **Griffon 100:** Shorter fuselage and heavy duty, cantilever landing gear. Standard 52.2 kW (70 hp) Subaru EA-71 water-cooled flat-four engine; options include 59.0 kW (79 hp) Hirth F30K, 61.0 kW (82 hp) F30E, 68.6 kW (92 hp) F30U, 75.0 kW (101 hp) F30ES; 59.6 (79.9 hp) Rotax 912 UL, 73.5 kW (98.6 hp) Rotax 912 ULS; 59.7 (80 hp) Jabiru 2200 and 89 kW (120 hp) Jabiru 3300. By 2006, this no longer appeared to be available.



Griffon 100M on display at Moscow in August 2005 (Yefim Gordon) 1158273

Griffon 100M: Longer fuselage and twin-oleo, strut-braced landing gear each side. Increased empty and max T-O weights. Standard 112 kW (150 hp) Subaru EJ-25; optional 97.0 kW (130 hp) LOM M132, 124 kW (166 hp) M332CE, Jabiru 3300 or 149 kW (200 hp) Jabiru 6000.

DESIGN FEATURES: Generally as Zenair STOL CH 701, except increased wing span and area.
POWER PLANT: As under Current Versions. Fuel capacity 80 litres (21.1 US gallons; 17.6 Imp gallons) standard; optionally, 100M only, 160 litres (42.2 US gallons; 35.2 Imp gallons).

DIMENSIONS, EXTERNAL:	
Wing span	10.23 m (33 ft 6 3/4 in)
Length overall: 100	6.40 m (21 ft 0 in)
100M	7.15 m (23 ft 5 1/2 in)
Height overall	3.12 m (10 ft 2 3/4 in)
Tailplane span	3.70 m (12 ft 3/4 in)
Wheel track	1.80 m (5 ft 10 3/4 in)

AREAS:	
Wings, gross	14.62 m ² (157.4 sq ft)
Horizontal tail (total)	2.77 m ² (29.82 sq ft)

WEIGHTS AND LOADINGS:	
Weight empty: 100	330 kg (727 lb)
100M	440 kg (970 lb)
Max baggage weight	20 kg (44 lb)
Max T-O weight: 100	600 kg (1,322 lb)
100M	750 kg (1,653 lb)
Max wing loading: 100	41.0 kg/m ² (8.41 lb/sq ft)
100M	51.3 kg/m ² (10.51 lb/sq ft)
Max power loading, Subaru: 100	11.30 kg/kW (18.57 lb/hp)
100M	6.71 kg/kW (11.02 lb/hp)

PERFORMANCE:	
Max level speed: 100	86 kt (160 km/h; 99 mph)
100M	97 kt (180 km/h; 112 mph)
Normal cruising speed: 100	54 kt (100 km/h; 62 mph)
100M	70 kt (130 km/h; 81 mph)
Stalling speed, flaps down	33 kt (60 km/h; 38 mph)
Max rate of climb at S/L: 100	240 m (787 ft)/min
100M	300 m (984 ft)/min
T-O run: 100	70 m (230 ft)
100M	40 m (135 ft)
Landing run	40 m (135 ft)
g limits	+6/-3

ILYUSHIN

MEZHDUNARODNYI AVIATIONNIYI KOMPANIYA ILYUSHINA (ILYUSHIN INTERNATIONAL AVIATION COMPANY)

Incorporating aircraft design and production companies, Ilyushin MAK formed April 2000 by government decree. Initial members are Ilyushin Aviation Complex and VASO; following negotiations with Uzbekistan, will be expanded to include TAPO as second production plant; previous Russian and Uzbek government agreement of 1998 covered collaboration in developing and marketing the Il-76 and Il-114. These plans overtaken in May 2001 by wider national strategy of merging Ilyushin, Beriev, Mil, Sukhoi and Yakovlev.

AVIATIONNIYI KOMPLEKS IMENI S V ILYUSHINA OAO (Aviation Complex named for S V Ilyushin JSC)
Leningradsky prospekt 45G, 125190 Moskva
Tel: (+7 095) 157 35 73
Fax: (+7 095) 212 02 75
e-mail: ilyushin@online.ru
Web: www.ilyushin.org
CHAIRMAN OF THE BOARD OF DIRECTORS AND GENERAL DESIGNER: Genrikh V Novozhilov
GENERAL DIRECTOR AND CEO: Victor V Livanov
HEAD OF INTERNATIONAL RELATIONS AND CHIEF DESIGNER: Igor Ya Katyrev
DEPUTY GENERAL DESIGNER, MARKETING, BUSINESS DEVELOPMENT AND FOREIGN ECONOMIC RELATIONS: Vladimir A Belyakov

Ilyushin OKB is named after Sergei Vladimirovich Ilyushin, who died 9 February 1977, aged 82. Bureau (OKB-240) was founded 17 April 1933; has been headed by Genrikh Novozhilov since 1970. About 60,000 aircraft of Ilyushin design have been built.
Funding problems and bank collapses have affected Ilyushin and some of its suppliers, delaying the establishment of an Il-114 leasing arm and the acquisition of Western systems for the Il-96T, which was eventually abandoned. However, Bureau is jointly designing IRTA-21 (formerly Il-214) twin-jet transport in collaboration with HAL of India and working with Yakovlev and Irkut on MS-21 twin-jet airliner. It is a partner, with Boeing and Sukhoi, in the

RRJ regional jet programme announced in August 2001 and selected for production in 2003. Collaboration with Boeing began in 1997 and resulted in August 2001 opening of joint design training centre in Moscow to provide engineers, mainly from Ilyushin, for Boeing's design and technical research centres in Russian capital.

ILYUSHIN II-76

By 1997, the TAPO plant at Tashkent, Uzbekistan, had laid down 960 Il-76s and Il-78s, of which 40 were then in various stages of completeness and available to meet medium-term orders. This 'white tail' stock had reduced to about 30 by July 2004, following purchases by India (six Il-78s), Volga-Dnepr (two Il-76RD-90VDs) and Silk Way of Azerbaijan (two Il-76TDs). In addition, two Il-76MF stretched variants have been ordered for delivery to the Russian Air Forces, and although the 2005 delivery date has slipped, they were confirmed late in that year to be under construction. In early 2006, target was to complete State Tests by end of 2006 and deliver to Russian Air Forces in 2007.

Further commitments by customers have encouraged TAPO to resume assembly of Il-76s, and in 2005 the 961st aircraft (line number 97-01) was noted on the production line. India ordered three aircraft on 5 March 2004, these to be modified with the addition of Phalcon AEW radars. First of these, KW3553, was under assembly in 2005. In September 2005, China reaffirmed a requirement for up to 38 aircraft, including four Il-78 tankers, with NPO Saturn D-30KP engines, over six years. China is pursuing its own AEW programme (KJ-2000) using Il-76 airframes. Unconfirmed report quotes two Il-76s on order for Jordan.

Il-76MF prototype (first flown August 1995) underwent Russian military evaluation in first half of 2003. Tashkent's first-stage flight test report issued on 24 April 2003 prior to immediate transfer of aircraft to Akhtubinsk test centre, although trials there were curtailed, and not due to have resumed until July 2004. Civil counterpart designated Il-76TF.

Associated requirement is transfer of production line from Uzbekistan to Russia (VASO plant at Voronezh), USD130 million cost of which may result in further delay. Some 70 MFs required by Russian Air Forces. Meanwhile, an initial batch of 10 to 14 existing Russian military Il-76MDs may be upgraded by VASO to Il-76MD-90 standard with PS-90A-76 turboprops replacing original D-30KPs, each upgrade costing USD14 million. Russian and Uzbekistan governments agreed joint marketing of Il-76 through Roseboronexport in March 2003.



First Il-76 upgraded with PS-90A-76 turbofans for Volga Dnepr airline as Il-76TD-90VD (Yefim Gordon)

1129544

First freighters with PS-90 engines were two Il-76TD-90VDs for Volga Dnepr, of which RA-76950 first flew on 5 August 2005 (and was exhibited at Moscow Salon later that month) having been produced from new-built 925th Il-76/Il-78 airframe. In late 2005, Silk Way ordered (via Uzavia Leasing) further two aircraft (fourth and fifth), these to be airline's first in -90TD configuration.

Kotlas-Novator (Leninets) has developed a 'glass cockpit' for Il-76TD-90VD as part of 13 new systems in this variant. New engines, rated at 142 kN (31,967 lb st), increase payload to 50,000 kg (110,230 lb) and MTOW to 195,000 kg (429,900 lb).

ILYUSHIN II-78M

NATO reporting name: Midas

There have been no recent conversions of Il-76 to this airborne tanker configuration. However, India ordered six Il-78MKIs in February 2001 and these were converted from stocks of uncompleted Il-76s held at TAPO in Uzbekistan. First two were officially transferred to India in March 2003 and final pair were transferred in late 2004. All Indian Il-78s have PS-90A-76 engines in place of D-30KPs of earlier aircraft. Russian Air Forces have requirement for additional tankers to be produced by conversion of existing transports under new designation Il-76MDK.

ILYUSHIN II-96-300

TYPE: Wide-bodied airliner.

PROGRAMME: First of two flying prototypes (SSSR-96000) flew at Khodinka 28 September 1988 and exhibited at Paris in June 1989; second (SSSR-96001) first flew 28 November 1989; further airframe used for static and fatigue testing; all three built at GAZ 30, Khodinka; areas of commonality with Il-86 permitted planned test programme to be reduced to 750 flights totalling 1,200 hours; route proving trials by second production Il-96-300 (SSSR-96005) conducted late 1991; production at VAPO (now VASO), Voronezh; certification received 29 December 1992.

Following initially poor reliability, Aeroflot (ARIA) serviceability improved, as evidenced by TBO increase from 1,600 to 4,130 hours between 1997 and 1999. PS-90A engine in-flight shutdown had improved to one per 29,000 hours by 1999. Aircraft delivered from 2005 have 96 per cent despatch reliability and 5,000 flying hours per year minimum guaranteed by manufacturer in first such agreement by Russian manufacturer.

Westernised Il-96MT versions developed during 1990s, but abandoned in mid-2001.

Two Il-96-300Ms delivered to Cubana from 2005 have latest international standard of navigation avionics and convertible interior from standard 18 business/244 economy to VVIP for President Castro.

CURRENT VERSIONS: **Il-96-300:** As described.

Il-96-300V: Extended-range version on order by Vnukovo Airlines, 1999. Increased fuel for additional 1,200 miles (2,222 km; 1,380 miles).

Il-96PU: One aircraft (RA-96012) built for use of Russian president; VIP interior, additional communications facilities by OAO Relero of Omsk and medical centre. Second aircraft, designated Il-96PU(M), authorised by Russian government on 6 May 2000; this has different interior layout; first flown 20 April 2003 with registration RA-96016; delivered to Rossiya 14 May 2003 for internal fittings by UK company Diamonite Aircraft Furnishing; intended 30 August 2003 delivery date as replacement 'Air Force One'.

Il-96-300 Freighter: Design under way by early 2000; development partnership also includes VAPO and Russian banks. To carry 70,000 kg (154,325 lb) payload over 4,859 n miles (9,000 km; 5,592 miles); uprated PS-90 engines each 176.5 kN (39,683 lb st). Estimated unit cost USD30 million (2000).

Il-96-400T: Under development by mid-2000 (when designation Il-96-3XX briefly employed). Equivalent to Il-96MT, but employing only Russian engines and avionics. Powerplant is Aviadvigatel PS-90A1 offering additional 14.67 kN (3,300 lb st) to allow full range at MTOW of 270,000 kg (595,250 lb), including 92,000 kg (202,825 lb) of cargo. Also shown in model form with 177 kN (39,683 lb st) Samara NK-93 turbofans. Span as Il-96-300 with winglets; length overall 63.94 m (209 ft 9½ in); height overall 15.715 m (51 ft 6¼ in). Range 5,399 n miles (10,000 km; 6,213 miles). Proposed to convert 10 uncompleted Il-96Ms to this standard for lease from Ilyushin Finance by Atlant Soyuz cargo airline; provisional agreement signed February 2001, envisaging 2003 service-entry; however, retrospective installation of cargo door could weaken airframe; Soyuz signed order for four -400Ts in August 2001, first being former Il-96T prototype, due in service early 2002; second -400 to follow 24 months thereafter; contract refinanced by 2005 and reduced to two. Also in 2001, Aeroflot issued letter of intent for four -400Ts to be delivered from 2006, and was considering passenger version. Volga-Dnepr reported in 2003 to have interest in further two.

Ilyushin Finance revealed in December 2004 that development under way of tanker/transport Il-96-400T for offer to Russian Air Forces as Il-78 replacement.

Il-98: Envisaged in late 1990s as Il-96 version with two Western engines (PW4000, RR Trent or GE90). By 2004, was being depicted with Samara NK-93s.

CUSTOMERS: Aeroflot Russian International Airlines (six delivered by 1996); Domodedovo Airlines (four ordered; three delivered by 1999); Russia State Transport Company (two; one delivered 1995; one in 2003); Atlant Soyuz (received first production aircraft in 1999,

following trials use and also acquired Il-96T prototype); and Krasnoyarsk Airlines (Kras Air; two; first delivery, RA-96014, 24 June 2004, entered service 21 August 2004; both on lease from Ilyushin Finance under agreement of 10 March 2004). Total 15 production aircraft delivered: 10th in 1996; 11th in April 1999; 12th in 2003; 13th and 14th in 2004; 15th in 2005.

Aeroflot signed lease agreement with Ilyushin Finance in November 1999 for further six -300s, plus sale, refurbishment and leaseback of one of original six; contract involves uncompleted aircraft on production line, with intention of delivery aircraft between 2001 and 2003. Target was not achieved but order remained in place, despite Aeroflot commitment to Il-96-400T. In March 2003, it was announced that VASO had received from Ilyushin Finance Company an initial payment of Rb180 million to fund restart of work on the eight Il-96s then on the assembly line, these comprising six for Aeroflot and two freighters for Atlant-Soyuz. By July 2004, VASO had relaunched production, intending to deliver six Aeroflot aircraft between July and December 2005 and two to Cubana in 2005 as VVIP transports for President Castro, following July 2004 order; sole 2005 production was first Cubana aircraft, rolled out on 26 July, exhibited at Moscow Salon in following month and handed over in December; second for Cubana first flew 14 January 2006. Aeroflot signed leasing agreement with Ilyushin Finance on 30 December 2003 for six to be delivered over a six month period, beginning mid-2005 (which date not achieved).

China Xinjiang Airlines previously was in protracted negotiations for three Il-96-300s. In 2005, China interested in four Il-96-400T freighters, and Syrianair in three Il-96-300s. Cuba decided in January 2006 to purchase third and fourth aircraft.

ILYUSHIN II-96 PRODUCTION

c/n	Registration	Current Operator
0101	RA-96000	To Il-96M and withdrawn
0102	nil	Static test airframe
0103	RA-96001	In storage at Zhukovsky
01001	RA-96002	Atlant Soyuz
01002	RA-96005	Aeroflot
01003	RA-96006	Domodedovo Airlines
01004	RA-96007	Aeroflot
01005	RA-96008	Aeroflot
01006	RA-96009	Domodedovo Airlines
01007	RA-96010	Aeroflot
01008	RA-96011	Aeroflot
01009	RA-96012	Rossiya
01010	RA-96016	Rossiya (delivered 14 May 03)
01011	RA-96017	Kras Air (delivered 9 Sep 04)
01012	RA-96015	Aeroflot (delivered by Jan 96)
01013	RA-96013	Domodedovo Airlines (delivered 16 Apr 99)
01014	RA-96014	Kras Air (delivered 24 Jun 04)
01015	CU-T1250	Cubana 2005
01016	CU-T1251	Cubana 2006
n/k	RA-96101	Atlant Soyuz (Il-96T)

Notes: Further six aircraft (four -300 and two -400T) under construction

COSTS: Il-96-300 USD9 million (2003). Il-96-400T USD38 million, flyaway (2001). Cubana Il-96-300 in VVIP configuration, USD50 million (2004).

DESIGN FEATURES: Superficial resemblance to Il-86, but new design, with different engines to overcome performance deficiencies of original Il-86; new structural materials and state-of-the-art technology intended to provide life of 60,000 hours and 12,000 landings; no lower deck passenger entry. Current development aiming at range of 6,475 n miles (12,000 km; 7,450 miles) with 300 passengers.

Conventional wide-bodied airliner, with low wing (and winglets) and four pod-mounted engines.

Supercritical wings, with 30° sweep at quarter-chord; sweepback at quarter-chord 37° 30' on tailplane, 45° on fin.

FLYING CONTROLS: Triplex fly-by-wire, with manual reversion; each wing trailing-edge occupied by, from root, double-slotted inboard flap, small inboard aileron, two-section single-slotted flaps, and outboard aileron used only as gust damper and to smooth out buffeting; seven section full-span leading edge slats on each wing; three airbrakes forward of each inboard trailing-edge flap; six spoilers forward of outer flaps; inboard pair supplement ailerons, others operate as airbrakes and supplementary ailerons; variable incidence tailplane; two section rudder and elevators, without tabs.

STRUCTURE: Basically all-metal, including new high-purity aluminium alloy, with composites flaps, maindeck floors and underfloor holds of honeycomb and CFRP; inner wings three-spar, outer panels two-spar; each wing has seven machined skin panels, three top surface, four bottom, with integral stiffeners; circular-section semi-monocoque fuselage;



Ilyushin Il-96-300 widebody airliner (Yefim Gordon)

1153790

leading- and trailing-edges of fin and tailplane of composites. Some components manufactured by PZL (Polish Aircraft Factory), Poland.

LANDING GEAR: Retractable four-unit type. Forward-retracting steerable twin-wheel nose unit; three four-wheel bogie main units. Two of latter retract inward into wingroot/fuselage fairings; third is mounted centrally under fuselage, to rear of others, and retracts forward after the bogie has itself pivoted upward 20°. Oleo-pneumatic shock-absorbers. Nosewheel tubeless tyres size 1,260x460; mainwheel tubeless tyres size 1,300x480. Tyre pressure (all) 11.65 bar (169 lb/sq in).

POWER PLANT: Four Aviadvigatel PS-90A turbopfans, each 156.9 kN (35.275 lb st), on pylons forward of wing leading-edges. Thrust reversal standard. Integral fuel tanks in wings and fuselage centre-section, total capacity 152,620 litres (40,318 US gallons; 33,573 Imp gallons).

ACCOMMODATION: Pilot, co-pilot and flight engineer; two seats for supplementary crew or observer. Ten or 12 cabin staff. Basic all-tourist configuration has two cabins for 66 and 234 passengers respectively, nine-abreast at 87 cm (34.25 in) seat pitch, separated by buffet counter, video stowage and two lifts from galley on lower deck. Two aisles, each 55 cm (21.65 in) wide. Two lavatories and wardrobe at front; six more lavatories, a rack for cabin staff's belongings and seats for cabin staff at rear. Seats recline, and are provided with individual tables, ventilation, earphones and attendant call button. Indirect lighting is standard. 235-seat mixed class version has front cabin for 22 first class passengers, six-abreast in pairs, at 102 cm (40 in) seat pitch and with aisles 75.5 cm (29.7 in) wide; centre cabin with 40 business class seats, eight-abreast at 90 cm (35.4 in) seat pitch and with aisles 56.5 cm (22.25 in) wide; and rear cabin for 173 tourist class passengers, basically nine-abreast at 87 cm (34.25 in) seat pitch, with aisle width of 55 cm (21.65 in).

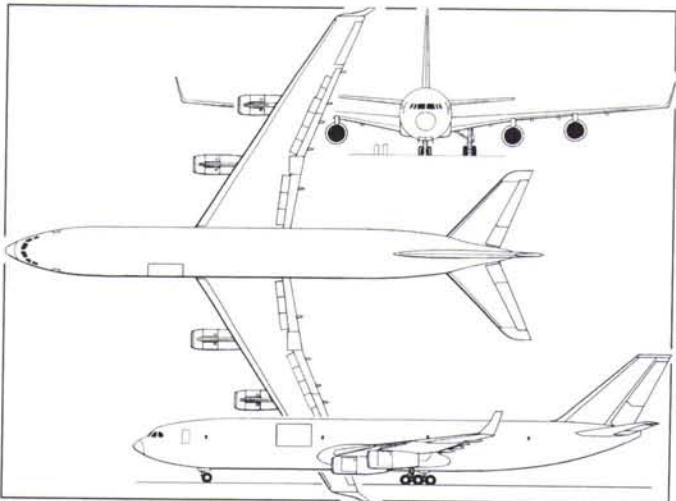
Future Aeroflot standard, defined (for Srs 300s) late 1999 as 12 first class, 21 business class and 180 economy seats, plus complete interior renewal. Refurbishment cost (including some Western avionics) USD1.5 million per aircraft. However, 2005 deliveries configured with 24 business class seats/beds (first on a Russian airliner) and 220 economy seats.

Passenger cabin is entered through three doors on port side of upper deck, at front and rear and forward of the wings. Opposite each door, on starboard side, is emergency exit door. Lower deck houses front cargo compartment for six ABK-1.5 (LD3) containers or igloo pallets, central compartment aft of wing for 10 ABK-1.5 containers or pallets, and tapering compartment for general cargo at rear. Three doors on starboard side provide separate access to each compartment. Galley and lifts are between front cargo compartment and wing, with separate door aft of front cargo compartment door.

SYSTEMS: Four independent hydraulic systems, using fireproof and explosion-proof fluid, at pressure of 207 bar (3,000 lb/sq in). APU in tailcone for engine starting and air conditioning on ground.

AVIONICS: *Flight:* Triplex flight control and flight management systems, together with a head-up display, permit fully automatic en route control and operations in ICAO Cat. IIIa minima. Duplex engine and systems monitoring and failure warning systems feed in-flight information to both the flight engineer's station and monitors on the ground. Autothrottle is based on IAS, without angle of attack protection.

Instrumentation: Primary flight information is presented on dual twin-screen colour CRTs, fed by triplex INS, a satellite-based and Omega navigation system and other sensors. Another electronic system provides real-time automatic weight and CG situation data.



Ilyushin Il-96-400T international freighter (Paul Jackson)

1159830

DIMENSIONS, EXTERNAL:

Wing span: excl winglets	57.66 m (189 ft 2 in)
over winglets	60.105 m (197 ft 2 1/4 in)
Wing aspect ratio	9.5
Length overall	55.345 m (181 ft 7 in)
Fuselage: Length	51.15 m (167 ft 9 3/4 in)
Max diameter	6.08 m (19 ft 11 1/2 in)
Height overall	17.55 m (57 ft 7 in)
Tailplane span	20.57 m (67 ft 6 in)
Wheel track	10.40 m (34 ft 1 1/2 in)
Wheelbase	20.07 m (65 ft 10 in)
Passenger doors (three): Height	1.83 m (6 ft 0 in)
Width	1.07 m (3 ft 6 in)
Height to sill: Nos. 1 and 2	4.54 m (14 ft 10 3/4 in)
No. 3	4.80 m (15 ft 9 in)
Emergency exit doors (three):	
Height	1.825 m (5 ft 11 3/4 in)
Width	1.07 m (3 ft 6 in)
Cargo compartment doors (front and centre):	
Height	1.825 m (5 ft 11 3/4 in)
Width	1.78 m (5 ft 10 in)
Height to sill: front	2.34 m (7 ft 8 1/4 in)
centre	2.48 m (8 ft 1 3/4 in)
Cargo compartment door (rear):	
Height	1.38 m (4 ft 6 1/4 in)
Width	0.97 m (3 ft 2 1/4 in)
Height to sill	2.74 m (9 ft 0 in)
Galley door: Height	1.20 m (3 ft 11 1/4 in)
Width	0.80 m (2 ft 7 1/2 in)

DIMENSIONS, INTERNAL:

Cabins, excl flight deck: Height	2.60 m (8 ft 6 1/4 in)
Max width	Approx 5.70 m (18 ft 8 1/2 in)
Volume	350.0 m ³ (12,360 cu ft)
Cargo hold volume: front	37.1 m ³ (1,310 cu ft)
centre	63.8 m ³ (2,253 cu ft)
rear	15.0 m ³ (530 cu ft)

AREAS:

Wings, gross	350.00 m ² (3,767.4 sq ft)
Vertical tail surfaces (total)	61.00 m ² (656.60 sq ft)
Horizontal tail surfaces (total)	96.50 m ² (1,038.75 sq ft)

WEIGHTS AND LOADINGS:

Basic operating weight	117,000 kg (257,950 lb)
Max payload	40,000 kg (88,185 lb)
Max fuel weight	122,100 kg (269,185 lb)
Max T-O weight	240,000 kg (529,100 lb)
Max landing weight	175,000 kg (385,800 lb)
Max zero-fuel weight	157,000 kg (346,125 lb)
Max wing loading	685.7 kg/m ² (140.45 lb/sq ft)
Max power loading	382 kg/kN (3.75 lb/lb st)

PERFORMANCE:

Normal cruising speed at FL330-FL400	464 kt (860 km/h; 534 mph)
Approach speed	140-146 kt (260-270 km/h; 162-168 mph)
Balanced T-O runway length	3,150 m (10,335 ft)
Balanced landing runway length	2,100 m (6,890 ft)
Range, with UASA reserves: with max payload	4,050 n miles (7,500 km; 4,660 miles)
with 30,000 kg (66,140 lb) payload	4,860 n miles (9,000 km; 5,590 miles)
with 15,000 kg (33,070 lb) payload	5,940 n miles (11,000 km; 6,835 miles)

OPERATIONAL NOISE LEVELS: Il-96-300 is designed to conform with ICAO Chapter 3 Annex 16 noise requirements

ILYUSHIN II-103

TYPE: Four-seat lightplane.

PROGRAMME: Exhibited in model form at Moscow Aerospace '90; programme go-ahead 1990; first flight (RA-10321) 17 May 1994; second prototype (RA-10302) flew 30 January 1995 at LMZ (now LAPIK), Lukhovitsy, following August 1993 decision to establish a production line there; pre-series batch comprised three flyable and two static test aircraft, former having flown 414 sorties in two years after maiden flight; first production aircraft flew 30 January 1995.

Type certificate by Russian authorities under AP-23 received 15 February 1996; production approval certificates issued 7 March 1996 and 7 April 1998; airworthiness certificate granted 9 July 1997. Amended Russian certification granted 4 December 1997, following addition of GPS, radio compass and AHRS to avionics suite.

FAR Pt 23 certification achieved 9 December 1998 (first by a Russian-built aircraft) after



South Korean Air Force Ilyushin Il-103 (Peter R Foster)

1151438

110-hour/208-sortie operation, but with 1,150 kg (2,535 lb) MTOW limit. Annex of 6 September 1999 allows operation from unpaved runways. FAR MTOW increased to 1,310 kg (2,888 lb) on 13 September 2002 (c/n 0501 onwards); retrofit available for earlier aircraft.

International marketing by MGA Ltd of Moscow (www.mga.ru). Initial export order, six for Peruvian Air Force, agreed June 1999 and finalised in April 2000; deliveries had not begun by August 2000, due to lack of payment, but all reported in service by late 2001.

CURRENT VERSIONS: **Il-103-01**: Baseline VFR version for Russian Federation market.

Il-103-10: Export version with fully upgraded avionics suitable for international airways navigation.

Il-103-11: Export version with partly upgraded avionics suitable for local air navigation. Initial certification is for a max T-O weight of 1,285 kg (2,832 lb), as reflected in weight and performance data below and as supplied to South Korea. The Il-103 will later be certified at 1,310 kg (2,888 lb) and, ultimately, 1,460 kg (3,218 lb).

Il-103LL: Flying testbed (*Lety Laboratoriya*) fitted in mid-2003 with Russkaya Avionika LCD navigation display and imported inertial platform.

Il-103SKh: Crop-sprayer (*selskokhozyaystvennyy*; agricultural) version; first flown 29 March 2000.

Il-103P: Surveillance version announced June 2002 in response to interest from Kazakhstan for Caspian Sea patrol. Undisclosed sensors have range of 40 km (64 miles) from cruising height of 3,000 m (9,840 ft). Potential for armament, including two machine guns.

CUSTOMERS: Initial operators (by 1999) included Il-Service at Myachkovo, Cherepovets Aviation Club, Avialesokhrana (forestry), Special Ecological Aviation Centre, Tatarstan National Flying Club, Civil Aviation Academy and St Petersburg Methodological Centre. Sales in 2000 comprised four to GP Bellesavia of Belarus in September for forest firefighting; one to Il-Service; and one for Vladimírsky Aerial Forest Protection. Despite prediction of Russian market for 1,500 and plans to produce 100 per year, sales stagnated in 2001; manufacture by LAPIK was reported, in mid-2000, temporarily to have ceased.

Russian Federal Air Transport service reportedly ordered 30 in 1999 for issue to several flying schools, but these failed to materialise. Total 23 delivered by January 2002, including 10 exports (Belarus, four, and Peru, six). Further sales in 2002 included 23 to South Korean Air Force (signed 16 May 2002) and three to Laos. Korean deliveries began October 2004; Laotian aircraft supplied July 2004. By 2006, over 50 produced.

COSTS: USD164,000 to 210,000 (2000). Korean programme unit cost (2003) USD391,000.

DESIGN FEATURES: Conventional low-wing monoplane, with non-retractable landing gear, originally to meet DOSAAF requirement for 500 military/civil pilot trainers. Designed for daytime VFR flying, in non-icing conditions and ambient air temperature of -35 to +45°C; intended service life 12,000 hours/20,000 landings/15 years.

Wing sweep 0° at quarter-chord, slight dihedral from roots, twist 0°, thickness/chord ratio 16 per cent at root, 15 per cent at tip, taper ratio 1.9.

FLYING CONTROLS: Conventional and manual. Actuation by pushrods, except cable-actuated rudder; horn-balanced rudder and single-piece elevator; single-slotted trailing-edge flaps, 0° or 10° deflection; electrically actuated elevator trim tab. Deflection angles: ailerons +25/-20°, elevator +25/-20°, rudder ±25°. Ground-adjustable trim tabs on starboard aileron and rudder.

STRUCTURE: All-metal, basically aluminium alloy, except for titanium firewall frame and wingroot attachments; bonded GFRP wingtips, elevator and rudder tips and elevator tab; and small amounts of magnesium alloys and Al-Li alloys. Single-spar wings, with front and rear false spars, integral fuel tanks and detachable leading-edge, mounted at sides of fuselage. Main spar is riveted beam with extruded caps; false spars stamped from sheet alloy; rolled sheet stringers. Semi-monocoque front/centre fuselage with inbuilt wing carry-through structure; separate rear fuselage; separate tailcone. Longitudinal fuselage members comprise two reinforced spars in cabin floor, two side-ribs of centre wing section and three beams for landing gear attachment. Two-spar, single-piece tailplane attached to fuselage by four bolts; two-spar fin. Detachable wheels, fin and tailplane.

LANDING GEAR: Non-retractable tricycle type, with single wheel on each unit. Cantilever spring nose and mainwheel legs of titanium alloy; castoring nosewheel with shimmy damper; oleo-pneumatic nosewheel leg tested on RA-10300 in 1998. Mainwheel tyres size 400x150-115, pressure 3.95 bar (57 lb/sq in) on KT-214-1 wheels; nosewheel tyre size 310x135-99, pressure 3.43 bar (50 lb/sq in) on K-290 wheels. Optional tyres 6.00-6 and 5.00-5,

respectively, on Parker 40-75B and 40-77B wheels. Multidisc hydraulic anti-lock brakes on mainwheels, pedal-actuated. Turning radius (outboard wheel) 4.70 m (15 ft 6 in). Floats and skis optional.

POWER PLANT: One 157 kW (210 hp) Teledyne Continental IO-360-ES2B flat-six engine; Hartzell BHC-C2YF-1BF/F8459A-8R two-blade, constant-speed (hydraulic), metal propeller. (Manual pitch control on three development aircraft; automatic pitch selection on production aircraft.) Alternative 194 kW (260 hp) Textron Lycoming or similarly rated Teledyne Continental engine under consideration. Fuel and oil systems suitable for inverted flight; two main fuel tanks in wingroots, total capacity 200 litres (52.8 US gallons; 44.0 Imp gallons); supply tank, capacity 3 litres (0.8 US gallon; 0.66 Imp gallon), in fuselage forward of wing front spar carry-through; gravity refuelling points in wingroots.

ACCOMMODATION: Two forward-folding seats side by side at front of cabin; bench seat for two adults or three children at rear; optional control wheel in place of standard stick; optional dual controls; optional front seats for parachutes; space for 220 kg (485 lb) freight with rear bench seat removed; two gull-wing window/doors, hinged on centreline, at front of canopy. Rear windows removable for ground emergency exit. Unrestricted access to baggage hold.

SYSTEMS: Cabin ventilated and heated and windscreen demisted electrically by fan heater. Electrical system 27 V DC, with 1,800 W 60 A generator and 25 Ah battery.

AVIONICS: *Comms*: Yurok VHF radio as standard; P-855A1 optional extra. Il-103-11 equipment includes UBD transponder. Il-103-10 has Bendix/King KX 165 nav/com/glideslope (replacing Russian radios) and KT 76A transponder.

Flight: BUR-4 flight data recorder.

Il-103-11 includes MKS-1 compass and Bendix/King KR 87 ADF and KLN 89B GPS (KLN 94 in South Korean aircraft). Il-103-10 additionally equipped with VOR/ILS, KN 63 DME, KMA 24 audio control/MKR, KCS 55A compass (MKS-1 in South Korean aircraft) and encoding altimeter.

DIMENSIONS, EXTERNAL:

Wing span	10.56 m (34 ft 7 3/4 in)
Wing aspect ratio	7.6
Wing chord: at root	1.825 m (5 ft 11 3/4 in)
at tip	0.96 m (3 ft 1 3/4 in)
Length overall	8.00 m (26 ft 3 in)
Fuselage: Length	7.81 m (25 ft 7 1/2 in)
Max height	1.42 m (4 ft 8 in)
Max width	1.40 m (4 ft 7 in)
Height overall	3.135 m (10 ft 3 1/2 in)
Tailplane span	3.90 m (12 ft 9 3/4 in)
Wheel track	2.405 m (7 ft 10 3/4 in)
Wheelbase	2.045 m (6 ft 8 1/2 in)
Propeller diameter	1.93 m (6 ft 4 in)
Baggage door: Width	0.70 m (2 ft 3 1/2 in)
Height	0.34 m (1 ft 1 1/4 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.65 m (8 ft 8 1/4 in)
Max height	1.27 m (4 ft 2 in)
Max width	1.30 m (4 ft 3 in)

AREAS:

Wings, gross	14.71 m ² (158.4 sq ft)
Ailerons (total)	1.137 m ² (12.24 sq ft)
Flaps (total)	2.204 m ² (23.72 sq ft)
Fin	0.84 m ² (9.04 sq ft)
Rudder	0.56 m ² (6.03 sq ft)
Tailplane	1.48 m ² (15.93 sq ft)
Elevator	1.56 m ² (16.79 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	900 kg (1,984 lb)
Baggage capacity	60 kg (132 lb)
Max payload	270 kg (595 lb)
Max fuel	150 kg (330 lb)
Max T-O weight	1,310 kg (2,888 lb)
Max wing loading	89.1 kg/m ² (18.24 lb/sq ft)
Max power loading	8.37 kg/kW (13.75 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	183 kt (340 km/h; 211 mph)
Max level speed	119 kt (220 km/h; 137 mph)
Cruising speed	97 kt (180 km/h; 112 mph)
Stalling speed: flaps up	64 kt (117 km/h; 73 mph)
10° flap	60 kt (111 km/h; 69 mph)
Max rate of climb at S/L	190 m (623 ft)/min
Max certified altitude	3,000 m (9,840 ft)
T-O run	380 m (1,250 ft)
Landing run	320 m (1,050 ft)
Max range at cruising speed, pilot and 270 kg (595 lb) payload, 30 min reserves	432 n miles (800 km; 497 miles)

g limits: Utility +4.4/-1.8
Aerobatic +6/-3

OPERATIONAL NOISE LEVELS: Designed to conform with GOST 23023-85 and ICAO Annex 16

ILYUSHIN II-112

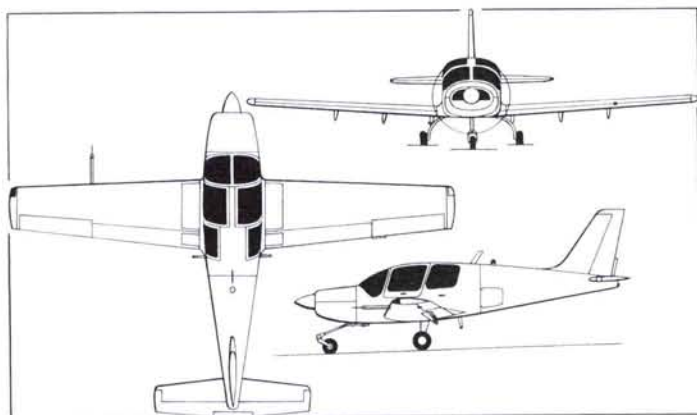
TYPE: Twin-turboprop transport.

PROGRAMME: Initiated 1994, with possibility of Russian government funding as alternative to Ukrainian Antonov An-38; design since enlarged and considerably refined; planned manufacture by KAPP at Kumertau and (Il-112V) VASO at Voronezh.

Revealed July 1999 that Il-112V selected by Russian defence ministry as potential replacement for Antonov An-24/26, Yak-40 and Let L 410; significant performance improvements to be achieved by redesign begun in same month. Presidential approval granted April 2000. First flight originally due in 2002, but revised timetable called off for final decision in that year between Il-112 and competitors. In April 2003, Il-112VT confirmed by Russian Air Forces selection committee as competition winner, overcoming opposition from Sukhoi Su-80-TD, MiG-110VT, Myasishchev M-60L/VTS and Tupolev Tu-136T. Four-year development programme launched following 17 November 2003 approval by Air Forces C-in-C of aircraft's technical specification. This called for preliminary design to be complete by early 2004, full scale development to begin in mid-2004 and first Il-112VT to fly in 2006 at VASO plant. Early delays to this timetable experienced when mockup commission postponed six months from planned date of June 2004.

Russian Air Forces C-in-C confirmed continued commitment to Il-112 in January 2006. Development costs funded 30 per cent by Russian government and 70 per cent from private finance. Completion of development phase due in 2008.

VASO at Voronezh to build three flying and two static test prototypes; first of former for



Ilyushin Il-103 two/five-seat multipurpose light aircraft (James Goulding)

1158062

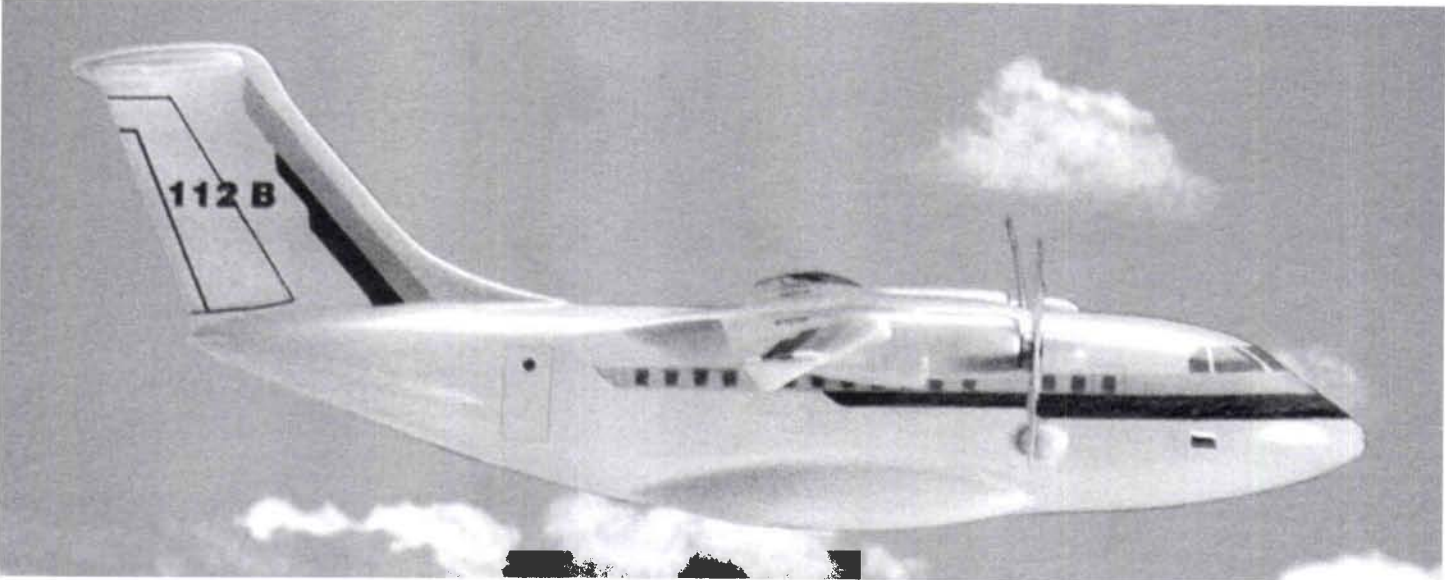


Illustration of Ilyushin Il-112V in 2004 showed a deeper, shorter fuselage than depicted previously

0589285

aerodynamic testing; second for avionics; third in military configuration. Series production to enter service with Russian Air Forces' transport test centre at Ivonovo.

CURRENT VERSIONS: **Il-112:** Passenger transport, as described in detail.

Il-112 business transport: Basically as Il-112 airline version, but cabin divided into three sections, separated by curtains. Front cabin contains four pairs of facing seats, with tables between, and centre aisle, a wardrobe on the port side between the door and flight deck bulkhead, inward-opening door to flight deck, and large baggage compartment on starboard side with outside access.

Central compartment has four armchairs on port side, with tables between, three-seat sofa on starboard side to rear of cabinets; aisle width between armchairs and sofa 86 cm (34 in); wardrobe at rear on each side. Rear section contains main passenger door with airstairs on port side, two buffets, seat for attendant, and access to rear baggage compartment and lavatory.

Il-112T: Civil freighter with rear-loading ramp; lavatory and seat for loadmaster at front of unobstructed main hold; ramp forms rear wall of hold when stowed. Typical payloads include four 1AK-1.5 (LD3) or five 3AK-1 containers or five PA-1.5 pallets. Airstair door at front of hold on port side; service door opposite; emergency exit on each side in centre of hold. Certification due 2008.

Il-112VT: (voenny transportny: military transport) Passenger/freighter for Russian armed forces. Rear ramp; provision for 35 passengers, or 18 stretchers or 34 paratroops. Patrol/surveillance version also to be produced. Detail design under way by early 2001; selected for production in April 2003.

CUSTOMERS: Requirement by Russian Air Forces could total up to 200, including telecommunications relay; estimated potential for 200 civil sales.

DESIGN FEATURES: Based on Il-114 airframe. Conventional high-wing monoplane with T tail; constant-chord wing centre-section, tapered outer panels; sweptback fin and rudder; circular-section pressurised fuselage.

FLYING CONTROLS: Entire trailing-edge of each wing made up of horn-balanced aileron and two-section, area-increasing flaps; two-section spoilers forward of flap on each side of centre-section. Horn-balanced rudder and elevator; tab in rudder.

LANDING GEAR: Retractable tricycle type; twin-wheel nose unit; single wheel on each main unit, retracting into large fairing outside fuselage pressure cell.

POWER PLANT: Two 2,090 kW (2,803 shp) Klimov TV7-117ST turboprops driving Aerosila AV-112 six-blade propellers in Il-112VT.

ACCOMMODATION: Flight crew of two; standard seating for 40 passengers, with 11 pairs of seats on port side and nine on starboard side of 45 cm (17.7 in) wide centre aisle. Maximum 60 in military version. Baggage/freight compartment with outside access on starboard side at front of cabin. Main airstair passenger door at rear of cabin on port side, with service door opposite; emergency exits at front of cabin on port side, in centre on starboard side. Access to rear baggage compartment and lavatory at rear of cabin; buffet and seat for attendant.

SYSTEMS: Aerosila TA-14 APU.

Following data generally refer to Il-112VT.

DIMENSIONS, EXTERNAL:	
Wing span	25.74 m (84 ft 5½ in)
Length overall	23.14 m (75 ft 11 in)
Height overall	8.87 m (29 ft 1¼ in)
DIMENSIONS, INTERNAL:	
Cabin freight volume	49.5 m³ (1,748 cu ft)
WEIGHTS AND LOADINGS:	
Max payload	6,000 kg (13,227 lb)
Max T-O weight	19,700 kg (43,431 lb)
Max power loading	4.715 kg/kW (7.75 lb/shp)
PERFORMANCE (estimated):	
Nominal cruising speed	297–313 kt (550–580 km/h; 342–360 mph)
T-O run	850 m (2,790 ft)
Landing run	550 m (1,805 ft)
Range: with max payload	540 n miles (1,000 km; 621 miles)
with 2 tonne payload	2,699 n miles (5,000 km; 3,106 miles)

ILYUSHIN Il-114

TYPE: Twin-turboprop airliner.

PROGRAMME:

DEVELOPMENT MILESTONES

Design submitted	1986
First flight	29 Mar 90
Certification	26 Apr 97
First flight, production	7 Aug 92

Design finalised 1986, as replacement for aircraft in An-24 class; was scheduled to enter service (with Aeroflot's Tashkent division) in 1992. Prototype (SSSR-54000) first flew at Khodinka 29 March 1990; second prototype (SSSR-54001) flew at Khodinka 24 December 1991, but lost in accident on 5 July 1993, resulting in withdrawal of government funding. Series production by TAPCO at Tashkent, Uzbekistan, initial aircraft comprising Nos. 0101, 0103 and 0105 for flight development plus 0102 for static tests and 0104 for dynamic tests; first production aircraft flew 7 August 1992. Certification delayed by loss of second prototype and deferred certification of TV7 engines, but finally achieved on 26 April 1997. Negotiations reportedly under way in 1996 for production at Esfahan by Iran Aircraft Manufacturing Company; this venture lapsed upon selection of rival Antonov An-140. Recent development effort centred on -100 version and upgraded TV7-117SM engine. Latter installed in Il-114 line number 0109 (Il-114LL RA-91003) in June 2004 for flight trials, at which time certification testing under way of modified TsPNK-114M autopilot for -100 version.

In 1998, Russian and Uzbek governments agreed to promote Il-114; Ilyushin and Inkombank signed provisional agreement for production funding (although the bank's trading licence was revoked shortly afterwards, resulting in further delays); and Uzbekistan Airlines took delivery of production aircraft, making first commercial flight on 27 August 1998.

CURRENT VERSIONS: **Il-114:** As described in detail.

Il-114T: Cargo version developed for Uzbekistan Airlines; port freight door, size 3.25 × 1.715 m (10 ft 8 in × 5 ft 7½ in) in rear fuselage; removable roller floor; cargo attendants' cabin at forward end of freight hold accommodates up to two persons, is smokeproof and variable in size. MTOW and performance as for Il-114 passenger version, except where otherwise indicated. First production example (RA-91005) flew at Tashkent 14 September 1996. Second (UK-91004) converted by 1998, but lost in accident 5 December 1999. Prototype delivered to LII at Zhukovsky in early 2000 for certification trials; these were continued in Yakutia in early 2002.

Il-114-N200S: Rear loading ramp version; none yet built.

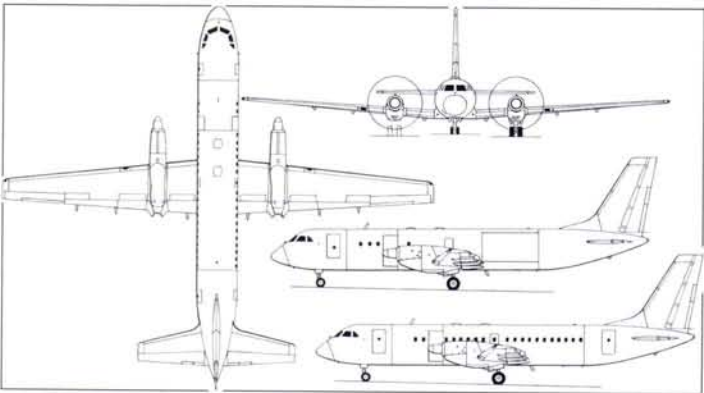
Il-114-100: With 2,051 kW (2,750 shp) P&WC PW127H turboprops, Hamilton Sundstrand 586E-7 six-blade propellers, Sextant avionics and new systems; primarily for export: English inscriptions and Imperial calibration; designated **Il-114PC** until late 1997; passenger and cargo (**Il-114-100T**) versions envisaged. Performance generally as Il-114, but with increased range and economy. Weight empty, equipped (including two crew) 16,100 kg (35,494 lb). Joint venture agreed by Ilyushin and P&WC on 16 June 1997; first flight at Tashkent (UK-91009) 26 January 1999; CIS Interstate Aviation Committee type certificate awarded 27 December 1999.

Il-114-X00: Under development by 2005; generally as Il-114-100 except NIIAO TsPNK-114M upgraded avionics, including some Rockwell Collins equipment and Barco displays (reportedly similar to ARIA suite of Beriev Be-200 Altair). Testbed to fly in 2006.

Il-114LL: Flying laboratory. RA-91003 employed as testbed by Radar MMS company; exhibited at Moscow Salon in 2005. TV7-117SM engines. Reportedly with Aisberg-Razrez survey and mapping radar.

Il-114M: With TV7M-117 turboprops, increased maximum T-O weight and 7,000 kg (15,430 lb) payload.

Il-114MA: Version of Il-114M with P&WC engines to carry 74 passengers at 324–351 kt (600–650 km/h; 373–404 mph) on 1,079 n mile (2,000 km; 1,242 mile) stages.



Ilyushin Il-114 short-range passenger transport, with additional side view (upper) of Il-114T freighter (Mike Keep)

0011989



Unique Ilyushin Il-114LL flying laboratory (Yefim Gordon)

1129462

Il-114P and Il-114MP: Maritime patrol versions. Described in 2001–02 and previous editions of *Jane's All the World's Aircraft*. Development continuing in 2005 and to be completed during that year. MP has Rolls-Royce 2100 engines.

Il-114FK: Military reconnaissance/cartographic survey version. Described in 2001–02 and previous editions.

Il-114PR: Announced October 2000; patrol, electronic intelligence gathering and electronic warfare. TV7-117S Srs 2 or PW127H engines.

Il-114PRP: As Il-114PR but alternative PW150 engines.

Il-140: Tactical air control (Il-140) and maritime patrol/SAR (Il-114M) versions under study by October 2000. No further reports, but at International Maritime Defence Show at St Petersburg in June 2003, Radar-MMS showed a model of an Il-114 with Il-20M style of sigint/LOROP camera fairings, dorsal (Il-22 style) and ventral antenna pods and pylon-mounted SLAR pods.

CUSTOMERS: Uzbekistan Airlines purchased two pre-series aircraft in 1994; later modified with extra lavatory, new galley and accommodation reduced from 64 to 52; each flew 300 hours before engine overhaul time expiry and grounding; airline operated both Il-114Ts on service trials in 1998 and had total requirement for 10 Il-114Ts, three of which on order in Il-114-100 configuration by April 2000 for delivery in March and April 2001, but failed to appear; first received in December 2002, with remaining two due in second half of that year, although further postponed, with first eventually in service by August 2004. Further two due by late 2004 and balance of six within next three years. Interest expressed by Bulgarian airlines; order for three Il-114-100s from Singaporean purchaser reported early 2000; delivery planned in 2001, although nothing further heard. Vyborg ordered three new aircraft in 2001 for operations from St Petersburg; deliveries planned for 2002 in 64-seat configuration, but first receipts, from August 2002, were two former Uzbekistan Airlines aircraft following their modification for flights in western European airspace. Vyborg services from St Petersburg began early May 2003 and "at least two" new aircraft were rescheduled for 2004 delivery and confirmed under assembly in mid-2004. Three (excluding prototype) owned by Ilyushin Bureau.

Total of 15 flying or substantially complete January 1998, most awaiting orders; delivery totals officially quoted as 1992 two, 1993 one, 1994 one, 1997 one and 1998 one. No further new production by end of 2001, when seven remained on assembly line, including two Il-114Ts; situation similar in late 2005, when "no fewer than 10" airframes, plus other subassemblies said to be present; by early 2002, components sets for first 40 production aircraft had been manufactured wholly or in part. Transaero opened negotiations in 2001 for between five and 10. In January 2006, Ilyushin's general director noted "preliminary orders for 30 aircraft".

COSTS: USD10 million for Il-114; USD8 million for Il-114T (2000).

DESIGN FEATURES: Conventional low-wing monoplane; only fin and rudder swept; slight dihedral on wing centre-section, much increased on outer panels; operation from unpaved runways practical. Service life of 30,000 cycles/30,000 hours/30 years, with overhaul at 6,000 hour intervals.

FLYING CONTROLS: Manual actuation for all except elevator; each wing trailing-edge occupied entirely by aileron, with servo and trim tabs, and hydraulically actuated double-slotted trailing-edge flaps, inboard and outboard of engine nacelle; two airbrakes (inboard) and spoiler (outboard) forward of flaps; spoilers supplement ailerons differentially in event of engine failure during take-off. Elevator control is FBW with back-up cable actuation. Trim and servo tabs in rudder, trim tab in each elevator.

STRUCTURE: Approximately 10 per cent of airframe by weight made of composites; two-spar wings; removable leading-edge on outer panels; circular-section aluminium alloy semi-monocoque fuselage built as five subassemblies; metal tail unit (CFRP tailplane and fin boxes planned for later aircraft).

LANDING GEAR: Retractable tricycle type, with twin wheels on each unit. All retract forward hydraulically; emergency extension by gravity. Oleo-pneumatic shock-absorbers. Tyres size 620x80 on nosewheels, 880x305 on mainwheels. Nosewheels steerable $\pm 55^\circ$. Disc brakes on mainwheels. All wheel doors remain closed except during retraction or extension of landing gear.

POWER PLANT: Two 1,839 kW (2,466 shp) Klimov TV7-117S turboprops (with potential to increase, as TV7-117SM, to 2,088 kW; 2,800 shp), each driving a low-noise six-blade Stupino SV-34 CFRP propeller. Integral fuel tanks in wings, capacity 8,780 litres (2,319 US gallons; 1,931 Imp gallons).

ACCOMMODATION: Flight crew of two, plus stewardess. Emergency exit window each side of flight deck. Four-abreast seats for 64 passengers in main cabin, at 76 cm (30 in) seat pitch, with central aisle 45 cm (17½ in) wide. Provision for rearrangement of interior for increased seating, removal of seats for cargo-carrying, and lengthening of fuselage for 70 to 75 passengers. Two passenger doors on port side: airstair door at front of cabin, further door at rear, both opening outward. Galley, cloakroom and lavatory at rear; emergency escape

slide by service door on starboard side. Type III emergency exit over each wing. Service doors at front and rear of cabin on starboard side. Baggage compartments forward of cabin on starboard side and to rear of cabin, plus overhead baggage racks. Optional carry-on baggage shelves in lobby by main door at front.

SYSTEMS: TsNPKO-114 autopilot began trials on Il-114-100 in 2001. Dual-redundant pressurisation and air conditioning system using bleed air from both engines; maximum differential 0.44 bar (6.4 lb/sq in). Two independent hydraulic systems, pressure 207 bar (3,000 lb/sq in), for landing gear actuation, wheel brakes, nosewheel steering, airbrakes and flaps. Three-phase 115/220 V 400 Hz AC electrical system powered by 40 kW alternator on each engine. Secondary 24 V DC system. Wing and tail unit leading-edges de-iced electrically by patented pulse wave system. Electrothermal anti-icing system for propeller blades and windscreen. Engine air intakes de-iced by hot air, APU in tailcone.

AVIONICS: Digital avionics for automatic or manual control by day or night, including automatic approach and landing in limiting weather conditions (ICAO Cat. I and II).

Instrumentation: Two colour CRTs for each pilot for flight and navigation information. Centrally mounted CRT for engine and systems data.

Flight: Barco computer for FMS.

DIMENSIONS, EXTERNAL:

Wing span	30.00 m (98 ft 5¼ in)
Wing aspect ratio	11.0
Length overall	26.875 m (88 ft 2 in)
Fuselage: Length	26.20 m (85 ft 11½ in)
Max diameter	2.86 m (9 ft 4½ in)
Height overall	9.185 m (30 ft 1½ in)
Tailplane span	11.10 m (36 ft 5 in)
Wheel track	8.40 m (27 ft 6½ in)
Wheelbase	9.13 m (29 ft 11½ in)
Propeller diameter	3.60 m (11 ft 9¾ in)
Propeller ground clearance	0.50 m (1 ft 7¾ in)
Propeller fuselage clearance	0.97 m (3 ft 2¼ in)
Passenger doors (each): Height	1.70 m (5 ft 7 in)
Width	0.90 m (2 ft 11¼ in)
Service door (front): Height	1.30 m (4 ft 3¼ in)
Width	0.96 m (3 ft 1¾ in)
Service door (rear): Height	1.38 m (4 ft 6¼ in)
Width	0.72 m (2 ft 4¼ in)
Emergency exit (each): Height	0.91 m (3 ft 0 in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Length between pressure bulkheads	22.24 m (72 ft 11½ in)
Cabin: Length	18.93 m (62 ft 1¼ in)
Width: max	2.64 m (8 ft 8 in)
at floor	2.28 m (7 ft 5¾ in)
Max height	1.92 m (6 ft 3½ in)
Cargo cabin volume (Il-114T)	76.0 m³ (2,684 cu ft)

AREAS:

Wings, gross	81.90 m² (881.6 sq ft)
--------------	------------------------

WEIGHTS AND LOADINGS:

Operating weight empty	15,000 kg (33,070 lb)
Max payload	6,500 kg (14,330 lb)
Max fuel	6,500 kg (14,330 lb)
Max T-O weight	23,500 kg (51,808 lb)
Max ramp weight	23,600 kg (52,029 lb)
Max wing loading	286.9 kg/m² (58.77 lb/sq ft)
Max power loading	6.39 kg/kW (10.50 lb/shp)

PERFORMANCE:

Max level speed	270 kt (500 km/h; 310 mph)
Cruising speed	254 kt (470 km/h; 292 mph)
Approach speed	100 kt (185 km/h; 115 mph)
Landing speed	87 kt (160 km/h; 100 mph)
Optimum cruising height: Il-114	7,600 m (24,940 ft)
Il-114T	6,000 m (19,680 ft)
T-O run: paved	1,360 m (4,465 ft)
Landing run: paved or unpaved	1,260 m (4,135 ft)
Range, with reserves:	
with 64 passengers	540 n miles (1,000 km; 621 miles)
with 1,500 kg (3,300 lb) payload	2,590 n miles (4,800 km; 2,980 miles)

INTERAVIA

INTERAVIA RADONEZH AO
(INTERAVIA RADONEZH JSC)

Repikhovo, Sergiev-Posad, Moskovskaya oblast
Tel: (+7 254) 305 04
Fax: (+7 095) 258 40 50
GENERAL DIRECTOR: Sergey Esayan

Interavia has marketed the I-1L high-wing lightplane and I-3 aerobatic sportplane and designed what is now the Smolensk (Technoavia) Finist. The 3,000 m² (32,300 sq ft) Radonezh plant at Repikhovo, near Zagorsk, a former medium-range ballistic missile factory, built 23 I-3s before production was moved to RSK 'MiG' at Lkhovitsy in 2004; first examples from here appear to have been delayed. Majority shareholding in Interavia is held by Eagle Aerospace of Switzerland.

INTERAVIA I-3

TYPE: Aerobatic two-seat sportplane.

PROGRAMME: Designed by former Sukhoi personnel, also responsible for Su-26, Su-29 and Su-31 aerobatic types. Batch of 50 I-3s begun by Tushinsky Mashinostroitelnyi Zavod AO (Tushino Machine-Building Plant Ltd), Moscow, in early 1990s to order of Chechnya, but embargoed by Russian government. Five were completed as Technoavia SP-91s, but definitive SP-95 version failed to materialise; however, four SP-91s exported to USA, where one incorrectly registered as an SP-95. Fifth (RA-44496) retained as demonstrator, but subsequently to Skydance Aero Team in Germany. Sixth, designated SP-91L, built in 2000 and also based in Germany with Yak Team (as RA-44522).

Prototype I-3 exhibited at Moscow Air Show in 1993. Exports to USA began in 1996, some being registered as E-3s. Production transferred from Tushino to Repikhovo, with final assembly at Myachkovo; now at Lkhovitsy.

CURRENT VERSIONS: **SP-91/95:** Built by TMZ for Technoavia as two-seaters.

I-3: Built by Radonezh for Interavia.

I-3M: Built by RSK 'MiG' for Interavia. Increased fuel capacity; 50 kg (110 lb) decrease in empty weight; flush rivets; revised instrument panel with improved (Western) nav aids; lightened canopy (including green tinted transparency); lightweight electrical system; wing/fuselage fairings; Western (Cleveland) wheels and (Parker) brakes; MT propeller; option of smoke system, strobe lights and 294 kW (394 hp) M-14PF engine.

As described.

Manufacture of I-3M began at Lkhovitsy in 2004, deliveries being due from March 2005, although subsequently delayed. In July 2006, announced that first I-3M due for delivery by end of 2006.

CUSTOMERS: Total of 23 built at Radonezh plant; last in 2004 for South African customer. I-3M had "15 or 16" orders by mid-2006.

COSTS: USD150,000 to 180,000 (2006).

DESIGN FEATURES: Conventional low-wing monoplane, capable of unlimited aerobatics; roll rate 345 °/s; tapered multispar wings of symmetrical section, without dihedral or anhedral; unswept tail surfaces with pointed rudder tip; clear-view blister canopy over one or two seats. At least two modified by removal of rudder tip. Convertible from two-seater to single-seater in 1 hour by removal of front cabin bay with control panel, installation of top fuselage panel and changing of canopy.

Wing incidence 0°; dihedral 0° at chord line.

FLYING CONTROLS: Manually actuated conventional horn-balanced elevators and horn-balanced rudder; 80 per cent span flaperons. Ground-adjustable tab on rudder; two suspended balance tabs on each flaperon. Control surface deflections: ailerons ±25°; elevators ±25°; rudder ±25°.

STRUCTURE: All-metal; semi-monocoque fuselage; fluted skin on fin, tailplane and all control surfaces.

LANDING GEAR: Tailwheel type, fixed; cantilever mainwheel legs. Mainwheel tyres size 400x150; tailwheel tyre size 200x80. Cleveland wheels and Parker brakes.



Single-seat Interavia I-3M

1121675

POWER PLANT: One 265 kW (355 hp) VOKBM M-14P nine-cylinder air-cooled radial engine driving an MT-Propeller MTV-9 three-blade, variable-pitch propeller. Fuel tank in each wingroot, combined capacity 120 litres (31.7 US gallons; 26.4 Imp gallons), of which 110 litres (29.0 US gallons; 24.2 Imp gallons) usable. Oil capacity 20 litres (5.3 US gallons; 4.4 Imp gallons).

ACCOMMODATION: One or two seats in tandem. Seats adapted for Western style flat parachutes and with Hooker harness.

SYSTEMS: Pneumatic system pressure 49 bar (711 lb/sq in).

DIMENSIONS, EXTERNAL:

Wing span	8.10 m (26 ft 7 in)
Wing aspect ratio	5.7
Length overall	6.72 m (22 ft 0½ in)
Tailplane span	2.72 m (9 ft 2¼ in)
Propeller diameter	2.40 m (7 ft 10½ in)

AREAS:

Wings, gross	11.54 m ² (124.2 sq ft)
Ailerons (total)	1.76 m ² (18.94 sq ft)
Fin	0.425 m ² (4.57 sq ft)
Rudder, incl tab	0.915 m ² (9.84 sq ft)
Tailplane	1.05 m ² (11.30 sq ft)
Elevators (total, incl tab)	1.25 m ² (13.45 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: single-seat	748 kg (1,648 lb)
two-seat	767 kg (1,692 lb)
Max T-O weight: ferry	1,200 kg (2,645 lb)
solo aerobatic	1,057 kg (2,330 lb)
Max wing loading, aerobatic	92.1 kg/m ² (18.86 lb/sq ft)
Max power loading, aerobatic	4.02 kg/kW (6.60 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	250 kt (463 km/h; 288 mph)
Max level speed	175 kt (324 km/h; 201 mph)
Manoeuvring speed	215 kt (398 km/h; 247 mph)
Stalling speed, flaps up, power on	33 kt (60 km/h; 38 mph)
Service ceiling	5,000 m (16,400 ft)
T-O run: paved runway	200 m (660 ft)
unpaved runway	262 m (860 ft)
Landing run: paved runway	452 m (1,485 ft)
unpaved runway	514 m (1,685 ft)
g limits: single seat	+12/-10
two seats	+10/-8

IRKUT

NAUCHNO-PROIZVODSTVENNAYA KORPORATSIYA IRKUT OAO
(IRKUT SCIENTIFIC-PRODUCTION CORPORATION JSC)

ulitsa Novatorov 3, 664020 Irkutsk
Tel: (+7 3952) 32 29 09

Fax: (+7 3952) 32 29 11

e-mail: market@irkut.ru

Web (1): www.irkut.ru

Web (2): www.irkut.com/ru

PRESIDENT: Oleg F Demchenko

GENERAL DIRECTOR: Vladimir V Kovalkov

CHIEF, PUBLIC RELATIONS: Elena Fedorova

AviaSTEP Design Bureau:

Leningradskiy prospekt D68 Str 1, 125315 Moskva

Tel/Fax: (+7 095) 777 21 01

e-mail: inbox@irkut.com

GENERAL DIRECTOR: Igor V Sorokin

Founded on 28 March 1932 and commissioned on 24 August 1934, as GAZ 125 (becoming GAZ 39 in 1941), Irkut has built some 6,500 aircraft of 16 types from Antonov, Ilyushin, MiG, Petlyakov, Sukhoi, Tupolev and Yakovlev bureaux and supplied them to 21 countries. In recent years, it has manufactured MiG-23UB trainers (1970-85); 165 kits for Indian-assembled MiG-27MLs; Su-27UB trainers (from 1986); and is currently responsible for producing the Su-30 fighter (since 1991) and Beriev Be-200 amphibian. Su-30 customers include China and India; offers Su-27UBM and Su-30KN upgrades to older aircraft. Series manufacture of the Yak-112 lightplane has been abandoned, although company has been allocated prospective manufacture of the Ilyushin/HAL Il-214 twin-jet transport. Also offers upgrades of Su-30, Mi-8, Mi-24, Aero L-39, Il-76 and Il-103.

Irkut shareholders are Brunswick UBS Warburg Nominees (25.72 per cent), Forpost Commercial Bank (20.60 per cent), FTK Company (20.35 per cent), APVK Sukhoi (14.70 per cent), Aerocom (10.18 per cent), other companies (4.9 per cent) and individuals (3.55 per cent). Subsidiary companies are Irkut Aviation Industrial Association (aircraft manufacturing plant), Beriev (39.57 per cent holding), Beta-Air (66.15 per cent), Russian Avionics (51 per cent), Irkut AviaSTEP (wholly owned), Itela (51 per cent), Techserviceavia (51 per cent), Hidroaviasalon (30 per cent) and Irkut private pension fund (wholly owned).

Is member of AVPK Sukhoi. Known from April 1989 until 2002 as IAPO (Irkutsk Aviation Industrial Association), having become a joint stock company in October 1992, but on 19 December 2002, shareholders approved a company change of name to Irkut NPK OAO, IAPO becoming a subsidiary. In 1997 was first Russian aviation enterprise to gain ISO 9002 status and in April 2001 became first Russian military production enterprise to issue short-term debt notes on financial market.

In 2000, IAPO branched out into design and manufacture of its own products in the form of the prototype A-002 autogyro, having acquired its own design bureau, AviaSTEP, in 1996. Expansion of civil programmes is strategic objective. The Irkut 111 design is for an ultra-wide-bodied regional airliner with twin fins and three-aisle configuration for only 106 passengers. This remains a long-term project, while Irkut continues to work on more immediate programmes, including contributing to the Ilyushin/Yakovlev MS-21 regional airliner.

Under government plans announced in May 2001, IAPO is to join the aerospace group also including Sukhoi, Ilyushin, Mil, Yakovlev and their associated factories. In August 2003, Irkut and Yakovlev announced plans for a joint venture company to manage their eventual merger, agreed in October 2003 by means of a 75.5 per cent share of Yakovlev stock, valued at US\$45 million. Employees in 2003 totalled 22,000 including 15,000 at IAPO factory; further 1,500 firms supply plant with materials. Irkut planned 20 per cent public stock flotation in 2004.

In September 2004, former Irkut President Alexey I Fedorov was appointed head of RSK 'MiG', fuelling speculation of possible merger of the two firms.

IRKUT A-002

TYPE: Three-seat autogyro.

PROGRAMME: Project announced October 2000; first product of Irkutsk Light Aircraft Design Bureau (OKB Legkoi Aviaty OAO), although an experimental version was tested in 1998. Designer: Andrey Tatarnikov. Almost complete prototype shown at Moscow, August 2001. Maiden flight 21 April 2002. Production launched August 2002. However, in October 2003, Irkut delayed deliveries to 2004 and curtailed production to five, pending further development. Nothing further heard until April 2005, when trials were reportedly nearing conclusion, with deliveries to begin in mid-2005. This also appears not to have taken place, but by early 2006 revised specification had been published, showing increases in rotor diameter (0.50 m; 1 ft 7¾ in), fuselage length (0.93 m; 3 ft 0½ in), empty (120 kg; 265 lb) and max T-O (50 kg; 110 lb) weights.



General arrangement of the Irkut A-002 autogyro 0121087

CUSTOMERS: First two deliveries were due in late 2003 to Susuman Susumanzoloto OAO mining company. Sales contracts then held for 20 aircraft; second buyer (also two) being Irkutskhehnergo OAO for powerline inspection.

COSTS: USD150,000 (2005).

DESIGN FEATURES: Conforms to FAR Pt 27 and Russian AP-27. Streamlined, cabin autogyro which can be stored and serviced in a motorcar garage. Choice of engines, including those using motorcar fuel. Classic configuration, with pusher propeller; single, sweptback fin with large rudder; broad track landing gear. Engine-driven pre rotation of rotor.

FLYING CONTROLS: Manual. All-moving tailplane mounted at one-third of fin height; horn- and mass-balanced rudder.

STRUCTURE: Generally of metal. Rudder and elevator of composites.

LANDING GEAR: Tricycle type; fixed. Cantilever-spring mainwheels; rubber in-compression shock-absorber on nosewheel. Mainwheel tyres 400x150; nose 300x125. Hydraulic disc brakes on mainwheels. Safety tail skid on prototype; auxiliary tailwheel on production version.

POWER PLANT: Prototype has one 157 kW (210 hp) Teledyne Continental IO-320 flat-six driving a fixed-pitch, two-blade propeller. Alternative engines of 134 to 157 kW (180 to 210 hp) and three-blade propeller can be installed. Subaru EJ 40 motorcar engine being preferred option.

ACCOMMODATION: Two front seats, side by side, with dual controls; single rear seat. Upward hinged door each side. Heating and ventilation provided.

DIMENSIONS, EXTERNAL:

Rotor diameter	10.30 m (33 ft 9½ in)
Length of fuselage	5.91 m (19 ft 4¾ in)
Height, rotor removed	3.30 m (10 ft 10 in)



Irkut A-002 three-seat autogyro prototype 0593357

Wheel track	2.40 m (7 ft 10½ in)
Wheelbase	2.015 m (6 ft 7¼ in)
Propeller diameter	1.90 m (6 ft 2¾ in)

AREAS: Rotor disc 83.32 m² (896.9 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	620 kg (1,367 lb)
Max T-O weight	900 kg (1,984 lb)
Max rotor loading	10.80 kg/m² (2.21 lb/sq ft)
Max power loading	5.75 kg/kW (9.45 lb/hp)

PERFORMANCE (157 kW; 210 hp) engine:

Max level speed	113 kt (210 km/h; 130 mph)
Min flying speed	33 kt (60 km/h; 38 mph)
Max rate of climb at S/L	210 m (689 ft)/min
Service ceiling	2,400 m (7,880 ft)
T-O run: jump start	zero
normal	40 m (135 ft)
Landing run	up to 10 m (35 ft)
Range	324 n miles (600 km; 372 miles)

ISTRA

ISTRINSKIY EKSPERIMENTALNIY MEKHANICHESKIY ZAVOD (ISTRA EXPERIMENTAL MECHANICS DEPOT)

Bunkovo Luchinskogo, Rayon Istrinskiy, 143550 Moskovskaya oblast

Tel: (+7 495) 786 89 86

Fax: (+7 495) 786 89 66

e-mail: info@istra.aero

Web: www.istra.aero

DIRECTOR: Yuri D Bazhanov

CHIEF ENGINEER: Eduard Bebeko

Istra EMZ formed 1997 as light aviation division of buildings materials company Vitek, and was previously known by that name. Promotion continues of the previous Ovod lightplane, of which only two appear to have been built. In March 2002, the company announced that it had completed design of the Ezhih agricultural aircraft, while a light helicopter project was unveiled in 2006. A three-seat lightplane and four-seat amphibian are also reported to be under development.

Company's 3,500 m² (37,675 sq ft) plant is capable of producing 30 light aircraft per year.

ISTRA EZHIK

English name: Hedgehog

TYPE: Agricultural sprayer.

PROGRAMME: Design begun in 1999 and completed by March 2002; construction of prototype then begun; public debut was then planned for August 2003 Moscow Salon but was rescheduled for the first half of 2004 and later revised to "Summer" 2004.

DESIGN FEATURES: Economic sprayer, with same payload as Sukhoi Su-38L, but at half purchase price. Raised cockpit with good forward/downward view. Constant-chord, low-mounted, cantilever wings; initially with sweptback tail surfaces with mutual wire bracing, but by mid 2005 had gained twin rectangular fins; narrow, deep fuselage. Fuel tanks designed to collapse in event of impact.

FLYING CONTROLS: Conventional and manual. No horn balances.

LANDING GEAR: Tailwheel type; fixed. Two side Vs hinged to lower longerons, plus half-axles attached to compression frame.

POWER PLANT: Initially intended to utilise one 154 kW (207 hp) LOM M337A six-cylinder piston engine operating on A-76 motorcar fuel; later revised to 157 kW (210 hp) Walter Minor M-337A. Fuel capacity 60 litres (15.9 US gallons; 13.2 Imp gallons).

ACCOMMODATION: Pilot only, in enclosed cockpit behind 'unbreakable' glass.

EQUIPMENT: Chemical hopper; eight rotary atomisers beneath wings. Motorised pump and sprayer being sourced from UK; distribution atomisers from USA; emergency purge takes 3 seconds; spray width 20 m (65 ft). Wire cutting system fitted in front of cockpit.

DIMENSIONS, EXTERNAL:

Wing span	12.00 m (39 ft 4½ in) ¹
Wing chord, constant	2.20 m (7 ft 2½ in)
Length overall	9.20 m (30 ft 2¼ in)
Height overall	3.05 m (10 ft 0 in)
Tailplane span	4.30 m (14 ft 1¼ in)

¹ Company literature also gives 11.00 m (36 ft 1 in)

AREAS:

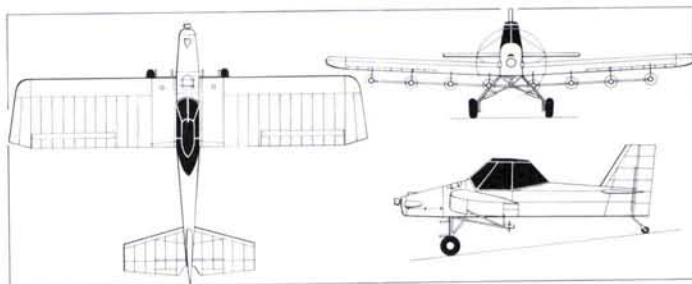
Wings, gross	24.25 m² (261.0 sq ft)
--------------	------------------------

WEIGHTS AND LOADINGS:

Weight empty	650 kg (1,433 lb)
Payload: normal	300 kg (661 lb)
max	360 kg (794 lb)
Max T-O weight	1,150 kg (2,535 lb)
Max wing loading	47.4 kg/m² (9.71 lb/sq ft)
Max power loading	7.32 kg/kW (12.03 lb/hp)

PERFORMANCE:

Max level speed	97 kt (180 km/h; 112 mph)
Spraying speed	59–81 kt (110–150 km/h; 68–93 mph)
Max rate of climb at S/L	270 m (885 ft)/min
T-O run	120 m (394 ft)
T-O to 15 m	260 m (853 ft)
Range	540 n miles (1,000 km; 621 miles)



Vitek Ezhih agricultural sprayer in its original configuration (James Goulding) 0525933



IEMZ Ezhih modified with twin fins (Yefim Gordon) 1158659

ISTRA ISTRA

TYPE: Two-seat helicopter.

PROGRAMME: Announced 2006.

DESIGN FEATURES: Intended to fulfil a variety of roles including flight training, patrol, aerial photography and mail flights.

FLYING CONTROLS: Conventional and manual. Automatic pitch-control mechanism with rigid drawbars. Cable-operated collective pitch for tail rotor.

STRUCTURE: Fuselage of welded steel tube cage and aluminium alloy skin; tailboom of aluminium alloy semi-monocoque. Rocker-style rotor hub with gyro-stabilisation. Composites rotor blades have negative twist and thickness ratio of 12 per cent.

LANDING GEAR: Aluminium alloy skid.

POWER PLANT: One 123 kW (165 hp) LOM M137 six-cylinder inline piston engine mounted vertically with single-level gearbox, belt-driven transmission and axial-flow blower cooling. All data provisional.

DIMENSIONS, EXTERNAL:

Main rotor diameter	8.00 m (26 ft 3 in)
Fuselage length	9.64 m (31 ft 7½ in)
Height to top of rotor head	2.99 m (9 ft 9¾ in)
AREAS:	
Main rotor disc	50.27 m² (541.05 sq ft)



Istra Istra light helicopter (Paul Jackson)

1158577

WEIGHTS AND LOADINGS:

Weight empty	380 kg (838 lb)
Max payload	180 kg (397 lb)
Max T-O weight	680 kg (1,499 lb)
Max disc loading	13.5 kg/m² (2.77 lb/sq ft)
Max power loading	5.52 kg/kW (9.08 lb/hp)

PERFORMANCE (two occupants):

Max operating speed	86 kt (160 km/h; 99 mph)
Range	162 n miles (300 km; 186 miles)

KAMOV

KAMOV OAO
(KAMOV JSC)

ulitsa 8 Marta 8a, Lyubertsy, 140007 Moskovskaya oblast

Tel: (+7 095) 700 32 04 and 171 37 43

Fax: (+7 095) 700 30 71 and 700 31 10

e-mail: kb@kamov.ru

Web: www.kamov.ru

GENERAL DESIGNER: Sergei V Mikheyev, PhD

DEPUTY GENERAL DESIGNER: Benjamin A Kasyanikov

CHIEF DESIGNERS:

Boris Gubarev (Ka-115)

Vyacheslav Krygin

Evgeny Pak

Aleksandr Piorzhnikov

Grigory Yakemenko (Ka-50)

Evgeny Sudarev

Formed in 1948 by Prof Dr Ing Nikolai Ilyich Kamov, this OKB originated in an experimental autogyro production plant operating in Moscow from 1940 to 1943. Kamov's initial brief was to design helicopters for naval use. Since the Ka-10 of 1949, Kamov helicopters have had coaxial contrarotating rotors; only the Ka-60/62, under development, have single main rotor, with anti-torque Fenestron. It was reported in September 2000 that a new transport helicopter, to compete against Western NH90 and S-92, is under development, but no further reports had been received by early 2005.

Since 1996, Kamov has been a member of the RSK 'MiG' consortium. Under plans announced in May 2001 by the Russian government, Kamov and MiG will be in the major aerospace grouping which also includes Tupolev, Aviatar, Aviacor and those factories producing Kamov helicopters, namely the Arsenyev factory (Ka-50) and the Kumertau factory (Ka-32 family). In 2002-03, Kamov was in the process of moving its flight test activities from the factory site at Lyubertsy to Chkalovsky, in the Shchelkovo area of Moscow Region, to escape the restrictions of urban development.

In September 2003, the Geralsy Group of Saudi Arabia announced plans for local manufacture of undisclosed Kamov helicopters. During the following month, Kamov agreed with Chinese industrial representatives on joint development of a fifth-generation combat helicopter, using Ka-50 and Ka-52 as a basis.

The affiliated Aero-Kamov Air Transportation Company (Tel/Fax: (+7 095) 700 31 60) operates a fleet of Ka-32s for diverse tasks, including firefighting, and has helicopters based in Russia, Canada and South Africa. Kamov Holding management company established in 2003 for financial and marketing functions.

KAMOV Ka-29, Ka-31 and Ka-35

NATO reporting name: Helix-B

TYPE: Medium transport helicopter; AEW helicopter.

PROGRAMME: Developed for AV-MF, following cancellation of proposed joint-service, tandem-rotor, multirole V-50 and its replacement by what became Ka-50, meeting Army requirement only. Ka-252TB prototype (also known as Izdelie D2B or Izdelie 502) first flew 28 July 1976, possibly with Ka-25 nose or original narrow Ka-27/Ka-32 nose. Production at Kumertau (KAPP) from 1984.

Entered service with Northern and Pacific Fleets 1985; photographed on board assault ship *Ivan Rogov* in Mediterranean 1987, thought to be Ka-27B and given NATO reporting name 'Helix-B'; identified as Ka-29 combat transport at Frunze (Khodinka) Air Show, Moscow, August 1989; Ka-31 radar picket version completed initial shipboard trials on aircraft carrier *Admiral of the Fleet Kuznetsov* (then *Thilisi*) 1990.

CURRENT VERSIONS: **Ka-29TB: ('Helix-B')** Armed derivative for day/night, VFR and IFR, transport and close support of seaborne assault troops; in-the-field conversion from one role to the other. Non-retractable landing gear and 50 cm (20 in) wider armoured flight deck. Reportedly used by Experimental Combat Group in Chechen War in 1996. No recent production known.

Detailed description generally as for Ka-32 except as under.

Ka-31: (formerly **Ka-29RLD:** *radiolokatsionnogo dozora*: radar picket helicopter) Development began 1980; company designation 03D2; first flown October 1987; two examples (031 and 032) tested on *Admiral of the Fleet Kuznetsov*; state testing completed in 1996; limited production launched (for Indian Navy) at Kumertau Aircraft Plant, Bashkirskaia, 1999.

Basic airframe of Ka-27 (which see in 2001-02 and earlier *Jane's*) with broader flight deck; E-801M or E-801E (export) Oke (eye) early warning radar system (E-801 in prototypes) by Radio Engineering Institute, Nizhny Novgorod, includes large (6.00 m; 19 ft 8¼ in) rotating radar antenna (area 6.0 m²; 64.5 sq ft) that stows flat against underfuselage and deploys downward, turning through 90° into vertical plane before starting to rotate at 6 rpm; landing gear retracts upward to prevent interference, nosewheels into long fairings. Once system has been switched on, antenna extended and operation mode selected, data on air targets flying below helicopter's altitude, and on water surface situation, are acquired, evaluated and transmitted automatically to command centre, requiring only two crew (pilot

and navigator, latter monitoring — but not operating — the system) in helicopter. Modes are air-surface, air-air or combined; in last-mentioned case, each sixth sweep is in surface mode. Kronstadt Kabris 31 GPS navigation and display system. Loiter speed 54 to 65 kt (100 to 120 km/h; 62 to 75 mph) at up to 3,500 m (11,480 ft); loiter duration 2 h 30 min. Maximum surveillance radius 62 n miles (115 km; 71 miles) for fighter-size targets (1.8 m²; 19 sq ft), horizon-limited for surface vessels (300 m²; 3,230 sq ft); up to 40 targets tracked simultaneously. Antenna can be retracted manually or explosively jettisoned in the event of a forced landing.

Two large panniers starboard side of cabin, fore and aft of main landing gear on helicopter numbered 032 (forward panniers only on 031); starboard airstair-type cabin door, aft of flight deck, divided horizontally into upward- and downward-opening sections, with box fairing in place of window; hatch window deleted above starboard rear pannier; new TA-8Ka APU positioned above rear of engine bay fairing, with slot-type air intake at front of housing, displacing usual ESM and IR jamming pods, gives radar and antenna an independent power supply. Tyre size 620x180 on mainwheels, 480x200 on nosewheels. Tailcone extended by fairing for flight recorder; no armour, gun door, stores pylons or outriggers.

Ka-33: Utility transport. Civilianised version of Ka-29TB shipborne assault transport. Designation revealed at Moscow Air Show in August 1997; no further details released and no known conversions.

Ka-35: Ground surveillance version of Ka-31, believed to have company designation 23D2; prototype '231' first flown November 2004 and believed to be a conversion of Ka-31 prototype '031', although company literature includes an illustration of '231' with other Ka-31s and fails to recognise the Ka-35 designation (which was first used for a heavy-lift twin-rotor helicopter project).

Radar based on E-801, although with slightly smaller scanner, measuring 5.50 m x 0.8 m (18 ft 0½ in x 2 ft 7½ in), rotating mechanically but with electronic elevation control. Crew of pilot and systems operator. Development status not revealed.

CUSTOMERS: Total of 59 Ka-29s built for Russian Federation Naval Aviation (about 45) and Ukrainian Navy (about 12). Following 1996 evaluation, four Ka-31s ordered in August 1999 by Indian Navy for delivery in 2001 and basing aboard aircraft carriers and 'Krivak' class destroyers; further five ordered February 2001. Additional 12 may be required. First flight of Indian Ka-31 (IN561) 16 May 2001; by October 2001, first two Indian airframes delivered from KAPP to Kamov at Moscow for avionics installation; flight trials completed of first two Indian aircraft by September 2002, with hand-over following soon after; second pair delivered in April 2003; last of nine delivered in 2004. In October 2002, Kamov reported a second export customer for Ka-31s in addition to Indian Navy; nothing further had emerged by mid-2005, although China, Brazil, Colombia and Venezuela all reportedly interested.

COSTS: Indian Navy batch of four priced at Rs4 billion (US\$92 million) (2000); second five cost US\$108 million (2001).

POWER PLANT: Two Klimov TV3-117VMA turboshafts, each 1,633 kW (2,190 shp). Indian Ka-31s have TV3-117MARS, with max continuous rating increased from 1,251 kW (1,677 shp) to 1,397 kW (1,874 shp). Engines started by APU. Fuel tanks filled with reticulated polyurethane foam for fire suppression. Total capacity (Ka-31) 3,060 litres (808 US gallons; 673 Imp gallons).

ACCOMMODATION: Wider flight deck than Ka-27 for two crew; three flat-plate windscreen glazings instead of two-piece curved transparency; 350 kg (772 lb) of armour around cockpit and engines; main cabin port-side door, aft of landing gear, divided horizontally into upward- and downward-opening sections, lower section forming step when open, to facilitate rapid exit of up to 16 assault troops; four stretcher patients, seven seated casualties and medical attendant in ambulance role; internal or slung cargo provisions.

AVIONICS: *Comms:* Two UHF and HF radios.



Prototype Kamov Ka-35 ground surveillance helicopter

1159318



Kamov Ka-31, showing radar deployed in nose view (James Goulding) 0130861

Radar: Primary radar in port side of nose.

Flight: INS; Doppler box under tailboom; IFF ('Slap Shot'). Ka-31 has Ramenskoye PNK-37DME flight and navigation system, providing extra stabilisation and vibration-clamping; INS-2000; A737 satellite navigation receiver; A-723/011 long-range navigation; SBKV-2V air data system; and SAU-37D autopilot.

Instrumentation: Ka-31 has two colour 152x203 mm (6x8 in) MFI-10-51 MFDs for pilot (left), plus analogue back-up flight instruments. Two PS3-1 MFDs in centre console. One MFI-10-51 for navigator/operator (right) displaying radar imagery and navigation data from GPS/Glonass.

Mission: Undernose Shturm-V missile guidance and LLTV pods; ESM 'flower pot' above rear of engine bay fairing.

Self-defence: L-166V IR jammer ('Hot Brick'); chaff/flare dispensers.

EQUIPMENT: Station-keeping light between ESM and jammer.

ARMAMENT: Four-barrel Gatling-type GShG-7.62 7.62 mm machine gun, with 1,800 rounds, flexibly mounted behind downward-articulated door on starboard side of nose; four pylons on outriggers, for two four-round packs of 9M114 Shturm (AT-6 'Spiral') ASMs and two UV-32-57 57 or B-8V20 80 mm rocket pods. Alternative loads include four rocket packs, two pods each containing a 23 mm gun and 250 rounds, or two ZAB-500 incendiary bombs. Internal weapons bay for torpedo or bombs. Provision for 30 mm Type 2A42 gun above port outrigger, with 250-round ammunition feed from cabin.

DIMENSIONS, EXTERNAL (A: Ka-29, B: Ka-31):

Rotor diameter (each)	15.90 m (52 ft 2 in)
Blade length, aerofoil section (each)	5.45 m (17 ft 10½ in)
Blade chord	0.48 m (1 ft 7 in)
Vertical separation of rotors	1.40 m (4 ft 7 in)
Length overall: excl noseprobe and rotors:	
A	11.30 m (37 ft 1 in)
B	11.25 m (36 ft 11 in)
rotors turning: B	12.25 m (40 ft 2¼ in)
Height overall: A	5.40 m (17 ft 8½ in)
B	5.60 m (18 ft 4½ in)
Width: between centrelines of outboard pylons	5.65 m (18 ft 6½ in)
over tailfins and centred rudders	3.65 m (12 ft 0 in)
of flight deck	2.20 m (7 ft 2 in)
Mainwheel track	3.50 m (11 ft 6 in)
Nosewheel track: A	1.41 m (4 ft 7½ in)
B	2.41 m (7 ft 11 in)
Wheelbase: A	3.00 m (9 ft 10 in)
B	3.05 m (10 ft 0 in)

AREAS:

Rotor disc (each)	198.50 m ² (2,136.6 sq ft)
-------------------	---------------------------------------

WEIGHTS AND LOADINGS (A, B as above):

Weight empty: A	5,520 kg (12,170 lb)
Max load: A, internal	2,000 kg (4,409 lb)
A, external	4,000 kg (8,818 lb)
Max combat load: A	1,800 kg (3,968 lb)
Normal T-O weight: A	11,000 kg (24,250 lb)
B	12,200 kg (26,896 lb)
Max T-O weight, internal load: A	11,500 kg (25,353 lb)
Max airborne weight:	
A, external sling load	12,600 kg (27,775 lb)

PERFORMANCE (A, B as above):

Max level speed at S/L: A	151 kt (280 km/h; 174 mph)
B	135 kt (250 km/h; 155 mph)
Nominal cruising speed: A	130 kt (240 km/h; 149 mph)
B	119 kt (220 km/h; 137 mph)
Loitering speed: B	54 kt (100 km/h; 62 mph)
Max rate of climb at S/L: A	888 m (2,910 ft)/min
Service ceiling: A	4,300 m (14,100 ft)
B	3,500 m (11,480 ft)
Loitering altitude: B	3,500 m (11,480 ft)
Hovering ceiling OGE: A	3,000 m (9,840 ft)
Combat radius: A, with six to eight attack runs over target	54 n miles (100 km; 62 miles)
B (datalink limited)	81 n miles (150 km; 93 miles)
Range:	
A, max standard fuel	248 n miles (460 km; 285 miles)
B	324 n miles (600 km; 372 miles)
A, ferry	400 n miles (740 km; 460 miles)
Loitering endurance at 3,200 m (10,500 ft): B	2 h 30 min

KAMOV Ka-32

NATO reporting name: Helix-C

TYPE: Multirole medium helicopter.



Kamov Ka-32A11BC operated by Spain's Helicopteros de Sureste

1128946

PROGRAMME: Development of Ka-27/32 began 1969; first flight of common prototype 1973; first Ka-32 (SSSR-04173) flew 8 October 1980; prototype of utility version shown at Paris Air Show June 1985; new military versions first exhibited at Moscow Air Show '95; Ka-32S and Ka-32T versions in production by KAPP; other conversions by Kamov at Lyubertsy through outfitting of KAPP airframes. Klimov VK-3000 turboshaft was to be certified in 2001 as alternative power plant, but no installations have been reported.

CURRENT VERSIONS: Most recent production has been of Ka-21A1 version; earlier types included Ka-32T, Ka-32S, Ka-32K and 'A2, 'A3 and 'A7 derivatives of Ka-32A.

Ka-32A: Assemblies and systems of basic Ka-32 modified in 1990-93 to meet all requirements of Russian NLG-32-29 and NLG-32-33 and US FAR Pt 29/FAR Pt 33 airworthiness standards in categories A and B. First flight September 1990; Russian type certificates obtained for Ka-32A and its TV3-117VMA engines in June 1993. Production began 1996. Larger tyres. Optional pressure fuelling with reduced fuel capacity. Maximum accommodation for 13 passengers. Advanced avionics available, including Canadian Marconi dual CMA-900 flight management system, with EFIS, AFCS, CMA-2012 Doppler velocity sensor and CMA-3012 GPS sensor. Modification of helicopters to Ka-32A standard started by Kamov 1994, customers purchasing Ka-32T airframe from KAPP plant and then engaging Kamov under separate contract for outfitting to Ka-32A standard.

Ka-32A1: Firefighting version of Ka-32A, first flown 12 January 1994. Equipped with Canadian or Russian variants of 'Bambi Bucket', capacity 5,000 litres (1,320 US gallons; 1,100 Imp gallons). Two operated by Moscow fire service, with doorway-mounted steerable water cannon and three types of rescue cage, able to lift two, 10 or 20 people from roofs of tall buildings. Other equipment includes searchlights and loudspeakers. Fire service aircraft and others flown by anti-riot police controlled by Aviatika Concern ISC, set up by Moscow city authorities and private investors to develop urban air transport system. Several on lease to South Korean forestry department have Simplex 10900-050 system, including 2,955 litre (780 US gallon; 650 Imp gallon) carbon fibre belly tank which can be refilled in 1½ minutes, plus 152 litre (40.2 US gallon; 33.4 Imp gallon) retardant tank. Ka-32 can also be fitted with 10900-055 system with two panniers totalling 5,000 litres (1,320 US gallons; 1,100 Imp gallons) of water and 250 litres (66.0 US gallons; 55.0 Imp gallons) of retardant.

One Moscow fire service helicopter (RA-31073) retrofitted with large, forward-facing nose boom for fire suppression in tall buildings; trials completed April 2001; shown statically at Moscow Salon, August 2001. System developed by Soyuz Federal Centre of Double Technologies at Dzerzhinsk; water supply of 2,800 litres (740 US gallons; 616 Imp gallons) carried in two underslung tanks or helicopter can be connected to fire vehicle on ground for unlimited supply; hose boom movable in vertical plane only.

Ka-32-10: Announced 25 May 2001; projected 24-seat civil version with enlarged cabin; internal payload 4,000 kg (8,818 lb). Target certification date was 2004; nothing further reported.

Ka-32A11BC: Built in accordance with requirements of Transport Canada, FAR Pt 29 certification gained 11 May 1998, but full clearance achieved 26 February 1999, after installation of dual actuators in flight control system; first Russian helicopter to gain Western certification. Two development aircraft delivered to VIH Logging in May 1997; flew 4,000 hours up to February 1999; also used for firefighting; further 10 produced by 2004, when further two ordered for Spanish operator, Helicopteros de Sureste (making four in that country from 2005) and one (making two) to Heliswiss of Switzerland. Further five ordered by undisclosed customer in November 2004. Designation sometimes mistakenly rendered as Ka-32A11VS, but BC indicates British Columbia — Canadian province where first used.

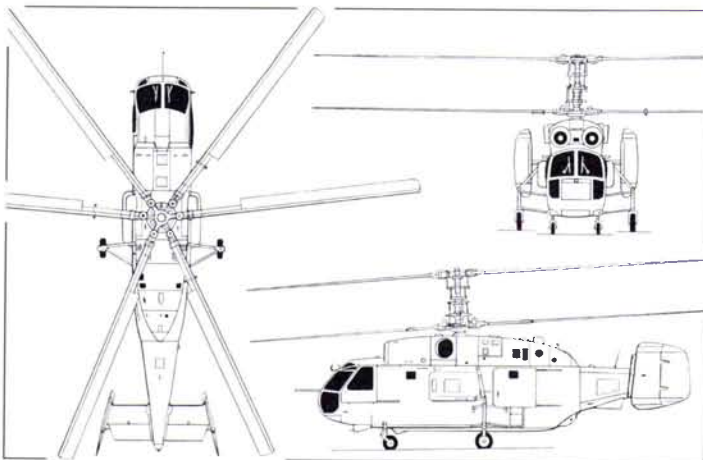
Ka-32A12: Version approved by Aviation Register of Switzerland.

Ka-32M: Under development by Kamov, to increase lifting capability to 7,000 kg (15,432 lb); retrofit with 1,839 kW (2,466 hp) TV3-117VMA-SB3 engines. Probably replaced in planning by Ka-32-10.

CUSTOMERS: Aeroflot and its successors; operators in Bulgaria (32S), Canada (32A), Laos (air force; six Ka-32T), Papua New Guinea (32A), South Africa (32A), Spain (two 32A11BC delivered mid-2005 augmenting lease of two), Switzerland (32A), Yemen (32S/T). Estimated 160-170 Ka-32s built up to 2004. Between December 1993 and November 2000, 36 imported by LGI of South Korea for operation by Forestry Service (23 Ka-32Ts), National Maritime Police Agency (eight Ka-32Ss), Kyonggi Provincial Fire & Disaster HQ (two Ka-32Ts) and Kyongsang Buk-do Fire Defence Aviation Corps. National Parks and Ulsan Fire Defence HQ (one Ka-32T each); further 10 ordered in March 2001 and three delivered by end of 2001. Further seven (for a total of 46) equipped for RoK Air Force SAR operations by Lahav Division of Israel Aircraft Industries, including Israeli navigation systems, weather- and ground surveillance radar and digital moving map; first delivery in July 2004. Korean deliveries reached 50 in December 2005.

Following lease of two (later three) Ka-32s, Cyprus government announced intention, August 2001, to purchase three. Algerian Air Force acquiring unknown number, three of which (two Ka-32T and one Ka-32S) noted at Sankt Peterburg in August 2002. Ka-32A11BC production totalled 10 by early 2005, with five to follow that year, including four more for Helisureste, ordered in November, 2005.

Russian security services expecting delivery in 2006 of between five and seven Ka-32s. **DESIGN FEATURES:** Conceived as completely autonomous 'compact truck', to stow in much the same space as Ka-25 with rotors folded, despite greater power and capability, and to operate independently of ground support equipment; special attention paid to ease of handling with single pilot; overall dimensions minimised by use of coaxial rotors, requiring no tail rotor, and twin fins on short tailboom: upper rotor turns clockwise, lower rotor anti-clockwise; rotor mast tilted forward 3°; twin turbines and APU above cabin, leaving interior uncluttered; lower fuselage sealed for flotation.



Kamov Ka-32T ('Helix-C') utility helicopter (two Klimov TV3-117V turboshafts)
(Dennis Punnett) 0507189

FLYING CONTROLS: Dual hydraulically powered flight control systems, without manual reversion; spring stick trim; yaw control by differential collective pitch applied through rudder pedals; mix in collective system maintains constant total rotor thrust during turns, to reduce pilot workload when landing on pitching deck, and to simplify transition to hover and landing; twin rudders intended mainly to improve control in autorotation, but also effective in co-ordinating turns; flight can be maintained on one engine at maximum T-O weight.

STRUCTURE: Titanium and composites used extensively, with particular emphasis on corrosion resistance; fully articulated three-blade coaxial contrarotating rotors have all-composites blades with carbon fibre and glass fibre main spars, pockets (13 per blade) of Kevlar-type material, and filler similar to Nomex; blades have non-symmetrical aerofoil section; each has ground-adjustable tab; each lower blade carries adjustable vibration damper, comprising two dependent weights, on root section, with further vibration dampers in fuselage; tip light on each upper blade; blades fold manually outboard of all control mechanisms, to folded width within track of main landing gear; rotor hub is 50 per cent titanium/50 per cent steel; rotor brake standard; all-metal fuselage; composites tailcone; fixed incidence tailplane, elevators, fins and rudders have aluminium alloy structure, composites skins; fins toe inward approximately 25°; fixed leading-edge slat on each fin prevents airflow over fin stalling in crosswinds or at high yaw angles.

LANDING GEAR: Four-wheel type. Oleo-pneumatic shock-absorbers. Castoring nosewheels. Mainwheel tyres size 600×180 (Ka-32); 620×180, pressure 10.80 bar (156 lb/sq in) (Ka-32A). Nosewheel tyres size 400×150 (Ka-32); 480×200, pressure 5.90 bar (85 lb/sq in) (Ka-32A). Skis optional. Floats available for rescue versions.

POWER PLANT: Two 1,633 kW (2,190 shp) Klimov TV3-117V (Ka-32) or TV3-117VMA (Ka-32A) turboshafts, with automatic synchronisation system, side by side above cabin, forward of rotor driveshaft. Main gearbox brake standard. Oil cooler fan aft of gearbox. Cowlings hinge downward as maintenance platforms. Fuel in tanks under cabin floor and inside container each side of centre-fuselage; capacity of main tanks 2,180 litres (576 US gallons; 480 Imp gallons); maximum capacity with two underfloor auxiliary tanks 3,450 litres (911 US gallons; 759 Imp gallons). Single-point pressure refuelling behind small forward-hinged door on port side, where bottom of tailboom meets rear of cabin.

ACCOMMODATION: Pilot and navigator side by side on air conditioned flight deck, in adjustable seats. Rearward-sliding jettisonable door with blister window each side. Seat behind navigator, on starboard side, for observer, loadmaster or rescue hoist operator. Alcohol windscreen anti-icing. Direct access to cabin from flight deck. Heated and ventilated main cabin of Ka-32 can accommodate freight or 16 passengers, on three folding seats at rear, six along port sidewall and seven along starboard sidewall (13 passengers in Ka-32A). Lifejackets under seats. Fittings to carry four stretchers. No provisions for lavatory or galley. Pyramid structure can be fitted on floor beneath rotor driveshaft to prevent swinging of external cargo sling loads. Rearward-sliding door aft of main landing gear on port side, with steps below. Emergency exit door opposite. Hatch to avionics compartment on port side of tailboom.

SYSTEMS: Three hydraulic systems; main system supplies servos, mainwheel brakes and hydraulic winch when fitted; standby system supplies only servos after main system failure; auxiliary system supplies brakes after main system failure and adjusts height of helicopter fuselage above ground; it can also be connected to main system for checking all functions on ground. Electrical system includes two independently operating AC generators and two batteries which cut in automatically or manually via inverters after AC generating system failure. After failure of either generator, the other is switched automatically to supply both circuits. Two rectifiers supply DC power. Electrothermal de-icing of entire profiled portion of each blade switches on automatically when helicopter enters icing conditions. Hot air engine intake anti-icing. APU in rear of engine bay fairing on starboard side, for engine starting and to power all essential hydraulic and electrical services on ground, eliminating need for GPU.

AVIONICS: *Comms:* Ka-32A11BC equipment includes SRT-651 U/VHF, SRT-170/L HF, M-424 transponder. SAR version optionally also R-851 emergency radio with four fixed frequencies.

Flight: Ka-32A11BC equipment includes INS-2000 INS, strapdown AHRS, DISS-32-28 Doppler, VIM-95 VOR/ILS, A-737 GPS, ARC-25 ADF, AN/ARN-153 TACAN, SVS-V-28-1-2 air data system, A-052 radar altimeter.

Instrumentation: Ka-32A11BC equipment includes MFI-10-6M MFD, control display unit, video recording system.

Mission: Ka-32A11BC equipment includes BAGER-53 mission processor. Optional GEO-ONV1 NVGs and GOES 337 VKA FLIR.

EQUIPMENT: Doors at rear of fuel tank bay provide access to small compartment for auxiliary fuel, and liferaft which ejects during descent in emergency, by command from flight deck. Container each side of fuselage, under external fuel containers, for emergency flotation bags, deployed by water contact. Optional LPG-300 rescue hoist, capacity 300 kg (661 lb), between top of door opening and landing gear. Optional external load sling, with automatic release and integral load weighing and stabilisation systems; cable lengths 10 m (33 ft), 20 m (66 ft) and 40 m (131 ft). Optional PSN-6AK liferafts (three) for SAR versions.

DIMENSIONS, EXTERNAL:

Rotor diameter (each) 15.90 m (52 ft 2 in)
Length overall: excl rotors 11.27 m (36 ft 11 3/4 in)
rotors folded 12.25 m (40 ft 2 1/4 in)

Width, rotors folded 4.00 m (13 ft 1 1/2 in)
Height to top of rotor head 5.45 m (17 ft 10 1/2 in)
Wheel track: mainwheels 3.515 m (11 ft 6 1/2 in)
nosewheels 1.41 m (4 ft 7 1/2 in)
Wheelbase 3.03 m (9 ft 11 1/4 in)
Cabin door: Height approx 1.20 m (3 ft 11 1/4 in)
Width approx 1.20 m (3 ft 11 1/4 in)

DIMENSIONS, INTERNAL:

Cabin: Length 4.52 m (14 ft 10 in)
Max width 1.30 m (4 ft 3 in)
Max height 1.24 m (4 ft 0 3/4 in)

AREAS:

Rotor disc (each) 198.50 m² (2,136.6 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 6,610 kg (14,573 lb)
Max payload: internal 3,700 kg (8,157 lb)
external 5,000 kg (11,023 lb)
Normal T-O weight 11,000 kg (24,250 lb)
Max flight weight with slung load 12,700 kg (27,998 lb)

PERFORMANCE (Ka-32):

Max level speed 140 kt (260 km/h; 162 mph)
Max cruising speed 130 kt (240 km/h; 149 mph)
Service ceiling 6,000 m (19,680 ft)
Hovering ceiling OGE 3,500 m (11,480 ft)
Hovering ceiling OGE, OEI 1,705 m (5,600 ft)
Range with max standard fuel 432 n miles (800 km; 497 miles)
Max range with auxiliary fuel 612 n miles (1,135 km; 705 miles)
Endurance with max standard fuel 4 h 30 min
Max endurance with auxiliary fuel 6 h 25 min

KAMOV Ka-50 CHERNAYA AKULA

English name: Black Shark

NATO reporting name: Hokum

TYPE: Attack helicopter.

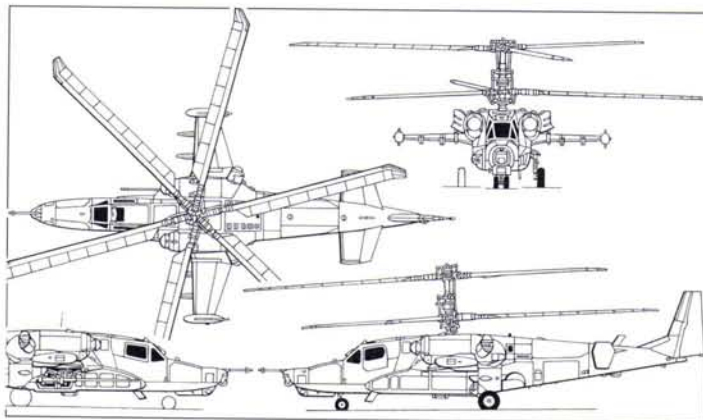
PROGRAMME: Project launched in December 1977 as **V-80** (*Vertolyet 80*; Helicopter 80); first prototype (010) built by Kamov bureau and hovered at Lyubertsy 17 June 1982 and flew on 23 July, powered by TV3-117V engines; second prototype (011) flew 16 August 1983 with TV3-117VMA engines and mockup of Shkval tracking system, Merkury LLLTV, cannon and K-041 sighting system; both prototypes were painted 'windows' to simulate fictitious rear cockpits. Initially reported in West in mid-1984, but first photograph did not appear (US Department of Defense's *Soviet Military Power*) until 1989.

First prototype lost in fatal accident on 3 April 1985; replaced by third prototype (012) with Mercury LLLTV system for state comparative test programme against Mil Mi-28, which completed in August 1986. Two preproduction **V-80Sh-1**s (014 and 015) were first to be built at Arsenyev and introduced UV-26 chaff/flare dispensers; second had K-37-800 ejection system and mockup of LLLTV in articulated turret. Ordered into production in December 1987. Further three for continued development work comprised 018 (first flown at Arsenyev 22 May 1991), 020 'Werewolf' and 021 'Black Shark'. (Export marketing name was originally Werewolf, but changed to Black Shark by 1996.) State tests of Ka-50 began in mid-1991 and type was commissioned into Russian Army Aviation in August 1993.



Kamov Ka-50 '18', believed the former '018', displayed in 2005, described as Ka-50Sh (Yefim Gordon)

1129453



Ka-50 ('Hokum') single-seat combat helicopter with scrap view of gun installation on starboard side (Mike Keep)

0507190